OPERATING AND SERVICE MANUAL

PRECISION NOISE GENERATOR 8057A

HEWLETT hp PACKARD

CERTIFICATION

The Hewlett-Packard Company certifies that this instrument was thoroughly tested and inspected and found to meet its published specifications when it was shipped from the factory. The Hewlett-Packard Company further certifies that its calibration measurements are traceable to the U.S. National Bureau of Standards for AC measurements and the Physikalisch Technische Bundesanstalt for DC measurements to the extent allowed by the Bureau's calibration facility.

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All Hewlett-Packard products are warranted against defects in materials and workmanship. This warranty applies for one year from the date of delivery, or, in the case of certain major components listed in the operating manual, for the specified period. We will repair or replace products which prove to be defective during the warranty period. No other warranty is expressed or implied. We are not liable for consequential damages.

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MODEL 8057A
PRECISION NOISE GENERATOR

SERIAL PREFIXED: G910

This manual is appropriate to instruments
with the serial number prefix:

1147G and below

08057–90001

PRINTED: May 1972

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GENERAL INFORMATION

1–1 INTRODUCTION

1–2 The Hewlett-Packard Model 8057A is a low-frequency, broad-band noise generator designed primarily for use in control system evaluations and applications requiring the simulation of pseudo-random disturbances.

1–3 The HP 8057A generates two kinds of noise signals: a two-level (binary) output signal and a continuous analog waveform which closely approximates Gaussian amplitude distribution. The binary signal is formed by a repeated series of noise patterns (or sequences) of known duration as generated by a shift register.

1–4 To produce the analog signal, a portion of the binary signal is fed to a digital-to-analog converter which acts as a digital filter to produce a sin x waveform (where x is an independent variable in the time domain) for the Gaussian output, further smoothing is carried out by an analog filter network to yield approximately rectangular "white" or 'pink' spectrums (Table 1–1) as required.

1–5 The noise output has a line spectrum, the harmonic spacing being established by the combination of clock period (ΔT) and sequence length (N). The product of ΔT and N gives the duration of pseudo-random noise pattern, and its reciprocal is the lowest frequency in the spectrum.

1–6 The level of the Gaussian output (available from a front panel connector) is variable by means of an attenuator, and the output impedance may be set to 50 or 600 Ohms (by a switch on the front panel). The binary output is delivered at a fixed level of +10V from a rear panel connector.

1–7 OPTIONS

1–8 The HP 8057A Options are described in Appendix 1.

1–9 ACCESSORIES AVAILABLE

1–10 Electronic test equipment, cables, connectors, and other accessory items are available from Hewlett-Packard. For more information on specific items consult the Hewlett-Packard Catalog or Sales/Service Office.

1–11 MANUAL IDENTIFICATION

1–12 This instrument carries a 9-character serial number on the rear panel, the first 4 characters of which are termed the serial number prefix. If the prefix does not agree with that quoted on the title page, reference should be made to the change sheets which are to be found in Appendix 2. To obtain further information for any instrument, contact the nearest Hewlett-Packard Sales/Service Office; always specify the model number and complete serial number.

1–13 ORDERING ADDITIONAL MANUALS

1–14 One manual is shipped with each noise generator. Additional manuals may be purchased from the local Hewlett-Packard field office (see list at rear of this manual for addresses). Specify the model number complete serial number prefix, and HP stock number provided on the title page.

Table 1–1. Specifications

NOISE OUTPUT

Period of Noise Pattern: Approx. 2 (for external clock 1,048,575 x clock period).

Harmonic Spacing (Δ f) :Approx. 0.5 Hz (for external clock, $\Delta f = \frac{\text{clock frequency}}{1{,}048{,}575}$)

WHITE NOISE

Power Spectrum: Rectangular, low pass. Nominal upper limit frequency (3 dB point) is 26 kHz (or 1/20th of external clock frequency).
Effective bandwidth: 27 kHz. Spectrum is flat within ± 0.3 dB up to 15 kHz and more than 25 dB down at 52 kHz.

Power Density: $362 \times 10^{-6}\,V^2/Hz = \frac{(\text{rms amplitude})^2}{\text{effect. bandwidth}}$

Crest Factor: 3.5

Probability Density Function: Near Gaussian

PINK NOISE

Power Spectrum: 3 dB/octave decreasing from 3 Hz to 20 kHz. Deviation from ideal decrease: ± 0.5 dB up to 15 kHz + 0 dB, – 1.5 dB at 20 kHz.

Intersection of White and Pink Noise Power Density Spectrum: Approx. 2.6 kHz.

Amplitude: 3,126 V rms ± 2% (i.e. 129.9 dB above 1 μV) (open circuit).

Amplitude Attenuator: 0.1, 1 and 10 dB steps from 20 to 129.9 dB above 1 μV. Overall attenuator accuracy ± 0.5 dB.

Output Impedance: 50 Ω or 600 Ω ± 3%.

DC Offset: < ± 50 mV from 32°F to 122°F (0°C to 50°C).

BINARY OUTPUT

Output Signal: Pseudo-random binary sequence (NRZ). Clock rate: 520 kHz (or external clock). Sequence length (clock periods per sequence): 1,048,575.

Amplitude: 10V ± 10%. (open circuit).

Output Impedance: Approx. 600Ω

Rise and Fall Times: < 70nsec.

TRIGGER OUTPUT

Positive trigger pulse indicates period of the noise pattern.

Trigger Pulse Amplitude: Approx. 10 V.

Output Impedance: Approx. 1 kΩ.

Trigger Pulse Width: 2 μsec. (or equal to clock period of external clock frequency).

EXTERNAL CLOCK INPUT

(Used only for white noise output, refer to paragraph 4–57).

Pos. Clock Pulses (min. + 2 V; max. + 20 V amplitude) (sine wave at least 4 V peak to peak)

Max. Clock Rate: 1 MHz

Min. Pulse Width: 30 ns.

Input Impedance: Approx. 1 kΩ.

GATE INPUT

Enable: + 4.5 to + 12 V.

Inhibit: – 1 to + 2.4 V(or connect to ground –2.5 mA is then delivered from the GATE INPUT connector).

Table 1–1 Specifications (cont'd)

OUTPUT TO EXTERNAL FILTER

(For noise spectra other than white or pink, connect external filter).

Pin 3	+ 15 V, output current 100 mA
Pin 1	– 15 V, output current 100 mA
Pin 2	Floating ground
Pin 4	Noise Output
Pin 5	Input from external filter.

GENERAL

Environment: Ambient temperatures from 0°C to 50°C and relative humidity to 95% at 40°C.

Power: 115 V or 230 V + 10%, – 15%, 50 Hz to 400 Hz, 14 VA.

Dimensions: Standard HP half module; 155 x 190 x 279 mm (6 x 7.75 x 11 inches).

Weight: Net, 3.5 kg (8 lbs); Shipping, 4.5 kg (10lbs).

INSTALLATION

2–1 INITIAL INSPECTION

2–2 Inspect the instrument for physical damage. After complying with the instructions given in paragraph 2–5, connect the instrument to the supply and carry out operational checks as soon as possible after delivery. If physical damage is evident,or if the instrument does not meet specifications when received, notify the carrier and the nearest Hewlett-Packard Sales/Service Office (see list at rear of this manual). The Sales/Service Office will arrange for repair or replacement without waiting for settlement of a claim with the carrier. The certification and warranty statements for all HP instruments are on the inside front cover of this manual.

2–3 The instrument is delivered complete with the following items (figure 2–1):

	Part Number
Manual	08057–90001
Power Cord	8120–1349
Fuse, 125mA, 230V operation	2110–0064
Fuse, 250mA, 115V operation	2110–0774
Board Extender, 15 pin	5060–0049
Board Extender, 18 pin	5060–1742

2–4 PREPARATION FOR USE

2–5 The Model 8057A may be operated from an ac source of 115 volts or 230 volts (+10%, −15%) at 50 Hz to 400 Hz. The power dissipation is 14VA. Carry out the following procedure if it is required to change the operating voltage:

a. Disconnect the instrument from the supply.

b. Remove the fuse and replace with a fuse of the appropriate value (paragraph 2–3).

c. Insert a narrow-blade screwdriver into the rear-panel voltage selector switch and slide the switch to expose the required setting (i. e. 115 or 230).

d. Insert the power cable and connect to the supply.

> CAUTION
> Be sure that the number visible on the voltage slide switch and the fuse value correspond to the line voltage used before operating the instrument; otherwise, the instrument may be damaged.

2–6 POWER CABLE

2–7 The Model 8057A is equipped with a 3-wire power cable which, when connected to an appropriate receptace, grounds the instrument, its cabinet and panel. To preserve this protection feature when operating the instrument from an outlet without a ground connection, use an appropriate adapter and connect the ground lead to an external ground.

2–8 ENVIRONMENT

2–9 Conditions during storage and shipment should be limited as follows:

a. Minimum temperature: −40°C (−40°F).

b. Maximum temperature: 75°C (167°F).

2–10 OPERATING LOCATION

2–11 The 8057A can be used on the bench or rack-mounted. When used on the bench it can be inclined for convenient operation of the front panel controls by means of the folding stand. Instructions for rack mounting are included in the rack mounting kit.

2–12 REPACKING

2–13 The original shipping carton and packing material can be used for reshipment. The Hewlett-Packard Sales and Service Office will also provide information and recommendations on material to be used if the original packing material is not available or is not reusable. If the instrument is to be shipped to a Hewlett-Packard Sales/Service Office for repair, attach a tag showing owner, model, serial number and repairs required.

Figure 2–1 Noise Generator and Supplied Items

Figure 3–1 Front and Rear Panels

FRONT PANEL

1 LINE ON – OFF control. Latching push button. When operated, the neon indicator lamp (above) glows.

2 NOISE SELECTION control. Push buttons, push – pull coupled for selection of either WHITE or PINK noise.

3 IMPEDANCE SELECTION control. Push buttons, push – pull coupled for selection of either 50 or 600Ω output impedance.

4 NOISE OUTPUT connector. Selected noise (WHITE OR PINK) is available at this BNC connector.

5 10dB ATTENUATOR switch. Attenuates output noise in 10dB steps.

6 1dB ATTENUATOR switch. Attenuates output noise in 1dB steps.

7 0.1dB ATTENUATOR switch. Attenuates output noise in 0.1dB steps.

REAR PANEL

8 CONNECTION to 8055A or any other external filter.

9 GATE INPUT connector. Any external signal level between –1V and +2.8V disables noise output.

10 CLOCK INPUT connector for external clock signal. NOTE: To be used only for WHITE noise output.

11 BINARY OUTPUT connector. Pseudo-random binary sequence of 1,048,575 bits. Amplitude: 10V.

12 CLOCK SELECTION switch. Slide switch selects internal or external clock.

13 TRIGGER OUTPUT connector. Positive going trigger pulse (≈ 10V), indicating the period of noise pattern.

14 OUTPUT CONNECTION switch. Slide switch connects noise output signal to the front-panel OUTPUT BNC either directly or via Model 8055A or any other external filter.

15 FUSE HOLDER

16 POWER SELECTION switch. Slide switch to select desired supply voltage.

17 POWER receptacle. The Model 8057A is powered by 230 or 115V AC, 50 to 400 Hz ac supply.

3–1 GENERAL

3–2 Refer to the control identification diagram (figure 3–1) and install the instrument as explained in Section II.

3–3 INTERNAL OPERATION

3–4 Set the controls as follows:

a. Depress LINE ON/OFF button **1** and verify that the lamp lights.

b. Press required NOISE button **2**.

c. Press required IMPEDANCE button **3**.

d. Set required output level on controls **5**, **6** and **7**.

e. Set switch **12** to INT.

f. Set switch **14** to NORMAL.

3–5 EXTERNAL FILTER

3–6 If the output is to be processed by an external filter, connect the filter to the 5-pin connector **8** on the rear panel (refer to table 1–1 for the pin allocation), and set switch **14** to EXT FILTER.

3–7 EXTERNAL CLOCK

3–8 Set up as in paragraph 3–3, set switch **12** to EXT and apply a suitable clock signal (table 1–1) to connector **10**. The external clock may be any frequency up to 1 MHz, but refer to paragraph 4–18 (if it is intended to use frequencies below 520 kHz) and to paragraph 4–16. The external clock facility should **not** be used when pink noise is required (see paragraph 4–57).

3–9 GATING

3–10 The noise generator may be gated off by applying a TTL low state (or ground connection) to connector **4**. The noise generator restarts when the TTL level goes high (or when the ground connection is removed).

4–1 INTRODUCTION

4–2 This section contains a brief description of the way in which the 8057A works, the explanation is based on the block diagram in figure 4–1.

4–3 The Shift Register

4–4 The shift register is a series of flip-flops each of which acts as a store for binary digital information ('bit'). Each stage can be in one of two stable states, thus it is said to contain a '1' bit if in the set state and a '0' bit if reset.

4–5 The shift register stages are connected in cascade so that on receipt of a clock pulse the binary combination is moved along one stage, i. e., each stage assumes the previous state of the stage driving it. If, as shown in figure 4–2, the output of two stages is fed back through an exclusive-or gate to the first stage, the register will generate a repeated series of identical sequences, known as a pseudo random binary sequence (p.r.b.s.).

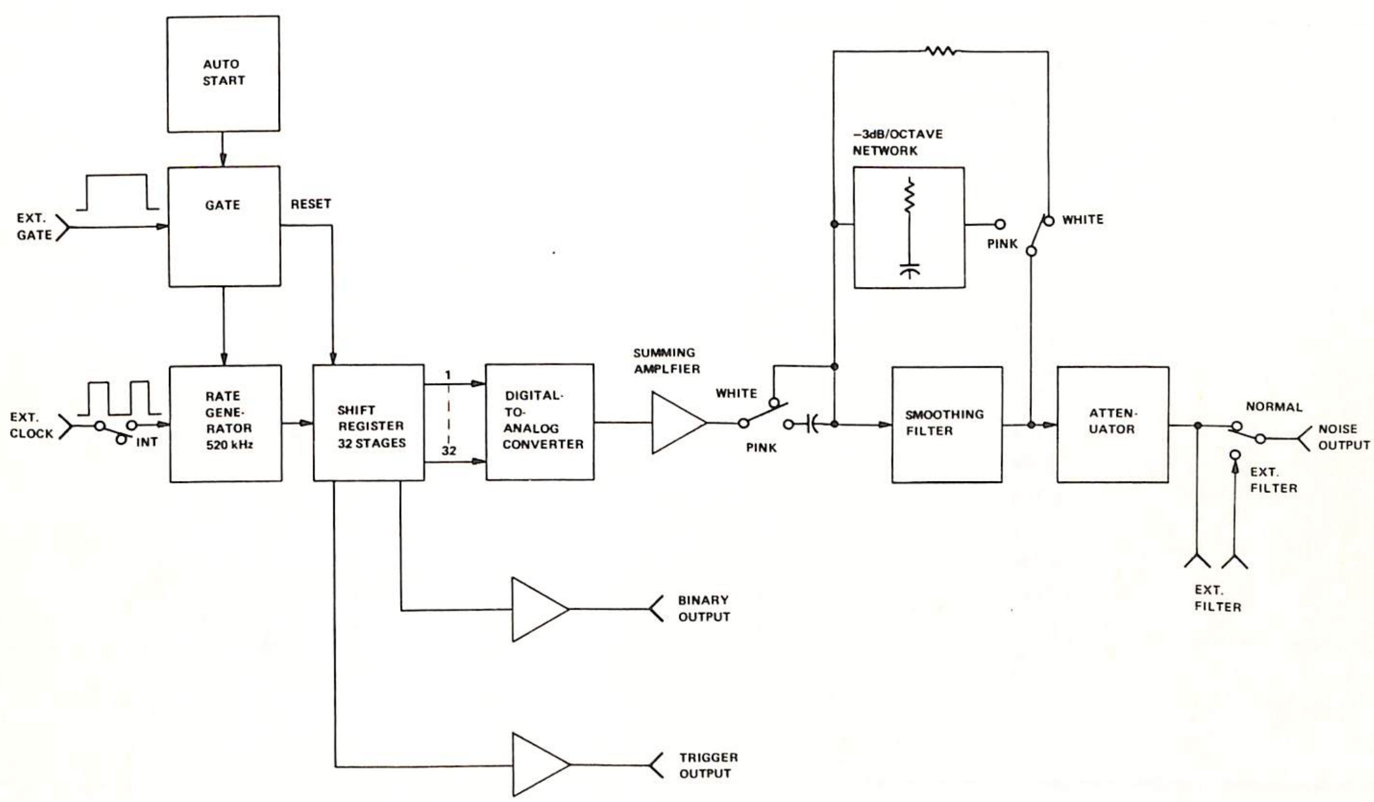
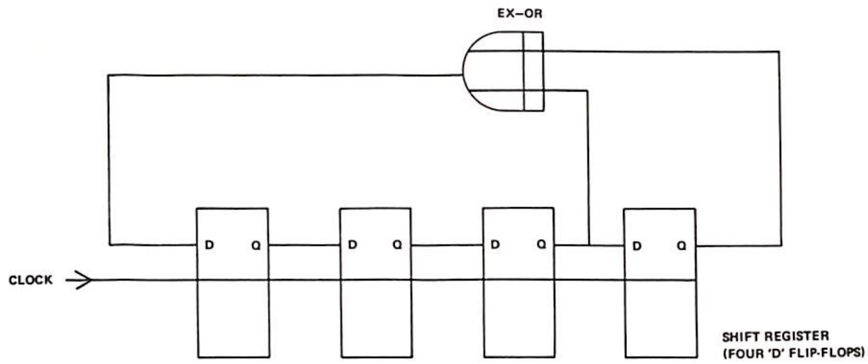


Figure 4–1 8057A Block Diagram



INITIAL STATE	**1**	**0**	**0**	**0**	
SUBSEQUENT STATES AFTER CONSECUTIVE CLOCK PULSES:					
1ST	0	1	0	0	
2ND	0	0	1	0	
3RD	1	0	0	1	
4TH	1	1	0	0	
5TH	0	1	1	0	
6TH	1	0	1	1	
7TH	0	1	0	1	
8TH	1	0	1	0	PRBS
9TH	1	1	0	1	
10TH	1	1	1	0	
11TH	1	1	1	1	
12TH	0	1	1	1	
13TH	0	0	1	1	
14TH	0	0	0	1	
15TH	1	0	0	0	

Figure 4–2. 15-bit Pseudo Random Sequence

It can be seen from figure 4–2 that the sequence will repeat itself every 15th clock pulse for a register of just 4 stages, also, it should be noted that the register never achieves a state with all stages at binary 0. For a shift register of n stages, the sequence length is $2^n - 1$.

4–6 In the HP Model 8057A Noise Generator the first 20 stages of a 32-stage register generate the p.r.b.s. (the output of the first 20 and remaining 12 stages is used to formulate the (sin x)/x waveform). Thus, under normal working conditions, the sequence will repeat itself after 1,048,575 clock pulses; for test purposes, however, the active length of the register is shortened to 10 stages, which gives a sequence of 1,023.

4–7 The Digital-to-Analog (D/A) Converter

4–8 The outputs of each of the 32 stages of the shift register are fed in parallel to the D/A converter about to be described in order to form a Gaussian signal.

4–9 However, consider first a simplified method of converting a binary signal into a multilevel analog waveform. Figure 4–3 shows a two-stage register coupled to weighting resistors of the same value. The circuit is so arranged that the current flowing through each resistor depends upon the state ('1' or '0') of its associated stage. Thus, the possible combinations with two stages are:

1. No current (both stages in '0' state).
2. One unit of current (either stage in '1' state).
3. Two units of current (both stages in the '1' stage).

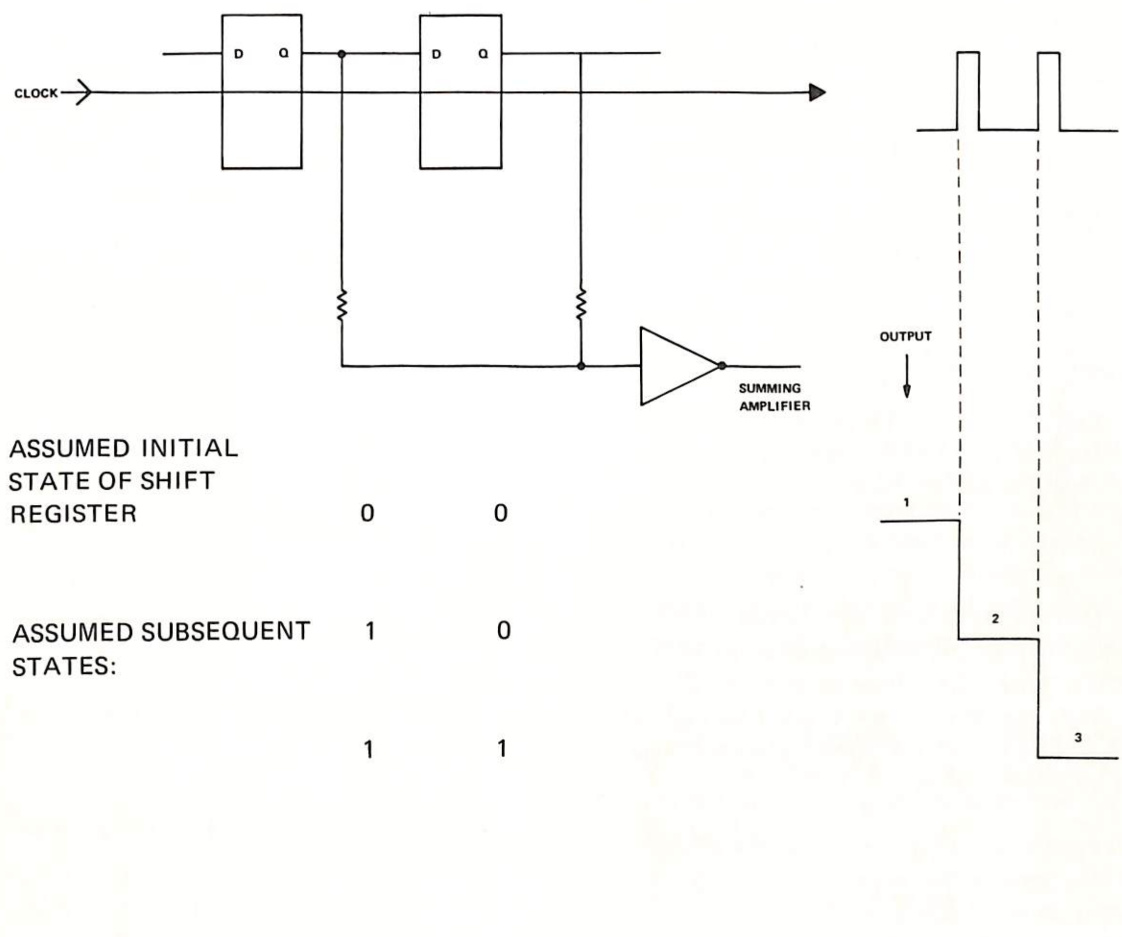


Figure 4–3 2-Stage Shift Register and D/A Converter

Hence the signal at the summing point can, at any given time, have one of three values, depending on the combination of bits in the two stages. Note that, as in normal shift register function, the pattern changes only when a clock pulse is received.

Clearly then, with a large number of shift register stages contributing to the output, the number of possible levels is increased. The device therefore derives a multi-level waveform from a two-level signal.

4—10 Now consider a single '1' pulse of width ΔT, applied to a 10-stage register (figure 4—4), driving ten identical loads. There is now no change in the output level at the summing point because the '1' passes from one state to the next. The output from the ten stages is therefore a stretched rectangular pulse. With clock pulses at intervals of ΔT, the width of the output pulse will be 10 ΔT.

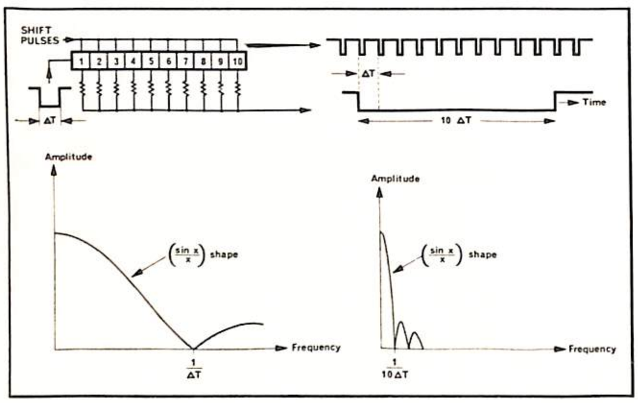


Figure 4—4. Comparison between the Frequency Spectrum of a Train of Pulses and the Equivalent Stretched Pulse.

4—11 A train of pulses of width ΔT has a (sin x) /x shaped spectrum with the first null occuring at the frequency 1/ΔT. Clearly, for a train of stretched pulses as in figure 4—4, the frequency of the first null is 1/10ΔT. That is to say that the signal band width has been reduced by a factor of 10.

4—12 In the 8057A the load resistors of the 32-stage shift register are chosen so that the current contribution at the summing point is graded, from one end of the shift register to the other, to follow the (sin x)/x curve (figure 4—5).

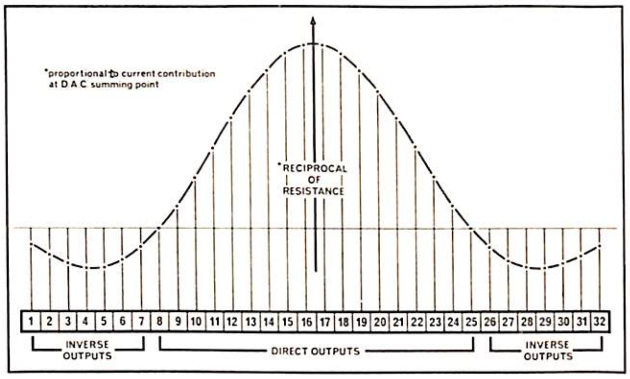


Figure 4—5. Weighting Resistors Chosen to give (sin x) /x Waveform

4—13 As shown in figure 4—5, the (sin x)/x curve is incomplete and stops short at a point in the second lobe on either side of the center line; this is because of the practical limitations on the size of the shift register. Note that the contributions to the signal made by the first and last seven groups of resistors is required to be the opposite polarity to that made by the resistors in the central group. This is achieved by supplying these two groups of resistors with the complement output signals from the respective register stages.

4—14 Therefore a single '1', starting at one end of the register and being conveyed (by a series of clock pulses), will generate a waveform as shown in figure 4—6 (as is the case when the 8057A is set to TEST).

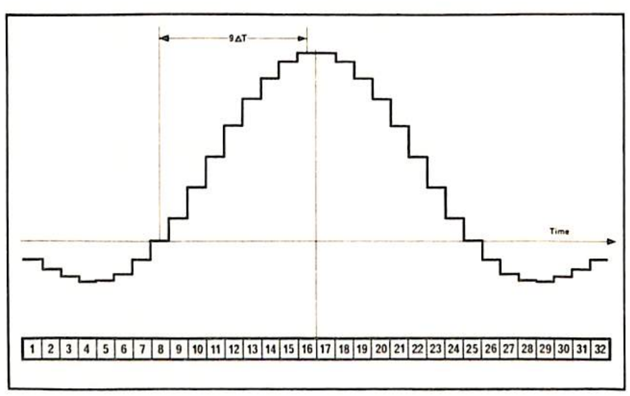


Figure 4—6. Time Waveform Generated by a Single Recirculating '1'.

4—15 In the normal mode the 20 active stages of the 8057A shift register generates the p.r.b.s. which is shifted throughout the complete length of the 32-stage register. The number of ones contributed to the output at any given time depends on the p.r.b.s. (and, therefore, also on the feedback loop which introduces a binary '1' at the input of the first register stage). Thus, a series of (sin x)/x curves will be apparent at the output of the D/A converter (figure 4—7) the sum of which results in a noise signal with an almost rectangular frequency characteristic, as shown in figure 4—8.

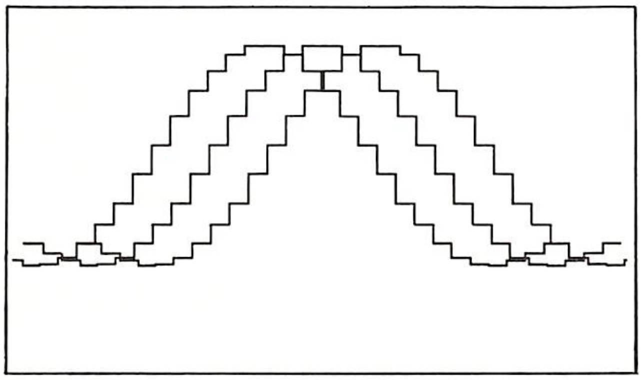
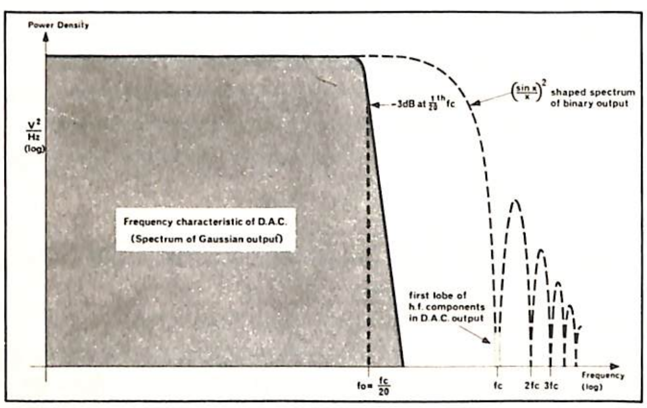


Figure 4—7. Time Waveforms generated by the Binary Sequence



DAC = Digital-to-Analog Converter

Figure 4—8 Output Spectrum of the D/A Converter

Owing to the limited size of the shift register, which results in truncation of the (sin/x)/x curve, the corner of the frequency characteristic is not perfectly square. The high frequency components in the output spectrum are caused by abrupt changes in the output levels as the pulses pass along the register and are removed by a smoothing filter (paragraph 4—17).

4—16 The design of the filter (shift register and D/A converter) is such that the half-power frequency of the Gaussian noise spectrum occurs at 1/20th of clock frequency. For example, with the internal clock frequency of 520 kHz, the relative power at 26 kHz is —3dB. The output from the digital filter is a multi-level signal having an approximately Gaussian distribution of amplitude and it is distinguished from a conventionally low-pass filtered signal only by the abrupt steps between levels. The amplitude of the probable density function (P.D.F.) of the multi-level signal is not significantly affected by the values of the weighting resistors assigned to the various shift register stages. The Gaussian nature of the P.D.F. arises mainly from the apparent randomness of the changing pattern of the binary signal within the shift register. Thus the P.D.F. attains a closer approximation to the Gaussian curve as the sequence length, and hence the randomness is increased. Note that the clock frequency (f_c) affects the spacing (Δf) between the harmonic components, and also the value of the half-power frequency (f_o).

4—17 Smoothing Filter

4—18 As previously mentioned, unwanted high frequency components in the output from the digital filter summing amplifier are removed by an analog smoothing filter. In analog computing applications, time derivates of signals occur frequently and, whenever a signal has sharp edges, there is a danger that the derivatives could cause overload. In the case of a stepped waveform, with its very fast transit times, even the first derivatives would be a series of very large amplitude spikes. For this reason, a second order analog filter is included in the 8057A to remove the sharp edges from the digital filter output waveform. As a result, neither the first nor the second time derivatives of the waveform yield sharp spikes. The P.D.F. for both derivatives is, therefore, reasonably Gaussian. Note that, when operating from an external clock with a frequency lower than the 520 kHz of the internal clock, the output becomes more and more step-like.

4—19 A circuit providing a 3dB per octave attenuation may be switched into the smoothing filter if a narrower ('pink') spectrum is required instead of the broader ('white') spectrum.

4—20 Output Attenuator

4—21 The output signal from the smoothing filter is applied to the attenuator which provides an output from 20 to 129.9dB above 1μV in 0.1dB steps.

4–22 For spectra other than those for white or pink, an external filter can be connected between the smoothing amplifier and the attenuator.

4–23 Trigger Output

4–24 A circuit is incorporated which outputs a trigger pulse when the first 20 stages of the shift register assume a particular content. The trigger thus identifies a particular event in the p.r.b.s. which may then be regarded as the 'start' and 'end' of the sequence.

4–25 Binary Output

4–26 The binary amplifier receives the p.r.b.s. from the output of the last stage of the shift register. The pulse sequence is amplified to a fixed output of 10 volts with an open circuit impedance of approximately 600 Ohms.

4–27 Automatic Start

4–28 Under normal working conditions, the 8057A shift register could not set itself to an all zero state. There is, however, a possibility that directly after switching the instrument on, all active stages of the shift register could assume the '0' state. This situation is prevented by a reset pulse, generated by an automatic start circuit, which ensures that the register is always started with the same pattern of ones and zeroes.

4–29 Clock Generator

4–30 An oscillator and a pulse shaping network are used to generate the shift register clock pulses which have a frequency repetition rate of 520 kHz on internal operation. When triggering externally, the clock pulse rate is the same as that for the trigger up to a maximum frequency of 1 MHz.

4–31 Gate

4–32 Positive signals (or open circuit) applied to the rear panel 'Gate Input' connector will gate the instrument on to produce bursts of noise. After gating, the clock generator is stopped and the binary state of the register stages is reset to a fixed combination.

4–33 DETAILED CIRCUIT DESCRIPTION

4–34 Shift Register (Figure 7–5)

4–35 The shift register uses 16 integrated dual D-Type Flip-Flops (MC1 to MV16) (Figure 7–2) of which MC1 to MC10 form the 20 active stages used to generate the p.r.b.s. Selected outputs are fed back to the first stage via the logic gate MC17, MC18 and MC19 and mode switch S1.

4–36 With the switch A2S1 (figure 7–3) set to N (for 'normal' operation), the active length of the register is 20 stages; when A2S1 is set to T (test), the active length is shortened to 10 stages. (See paragraph 4–6 for sequence length).

4–37 When the instrument is turned on, a pulse from Q37 of the automatic start circuit is applied to the set or reset of each flip-flop stage, so that the initial state of the shift register is set up as follows: 1111 1110 0011 1100 0000 0111 0001. The shift register also starts with this combination each time the clock generator is enabled by a gate signal. Clock pulses applied to each stage are from the output of Q45 and Q46.

4–38 Digital-to-Analog Converter (Figure 7–5)

4–39 Each D/A converter consists of a clamping network which uses a transistor (Q1 to Q30) and its associated resistances. The operating voltage (+11.7 volts) is supplied by the voltage source comprising of A3Q23 and Q25 (figure 8–10).

4–40 With the exception of stage 8 and 25, every stage is allocated a precision weighting resistor, R31 to R84. Stages 8 and 25 do not contribute to the signal because the output at that point corresponds to the zero crossing point of the (sin x)/x waveform (figure 4–6). The output from the weighting resistors is applied to the summing amplifier.

4–41 Summing Amplifier, Smoothing Filter and RC Network

4–42 The transistors Q1 and Q8 form the summing amplifier. The signal from the weighting resistors (R31 to R84) has a dc offset which is neutralized by the application of a negative voltage via R2 and R3. The white noise signal is adjusted for dc offset zero by R2 and the pink noise signal by R70. The white noise rms amplitude is adjusted by means of R68 and the pink noise rms amplitude is adjusted by R65. For white noise the filter is dc coupled to the summing amplifier, in PINK mode the filter is ac coupled to the summing amplifier via C12 and C13 and incorporates the RC network R43 to R52 and C15 to C23.

4–43 The input stage (Q1) is part of a differential amplfier, the output of which is further amplfied by a

second differential amplifier (Q3 and Q4); the high frequeny response is compensated by C1 and Q6. A balancing resistor R5 is connected between the collectors of Q1A–B to minimize the loading effects of Q3 and Q4 upon the amplitude. The emitter followers Q7 and Q8 are forward-biased by CR1 and CR2; the output signal (inverted with respect to the input signal) is connected via a feedback link, R12/R65, to the amplitude input.

4–44 The smoothing filter circuit is similar to that of the summing amplifier but is connected (by means of R19, R20, C4 and C5) as an active filter with a cut-off frequency of 110 kHz. In the PINK MODE the filter is ac coupled to the summing amplifier via C12 and C13 and incorporates the RC network R43 to R52 and C15 to C23.

4–45 Attenuator (Figure 7–9)

4–46 The attenuator is a ladder attenuator with separate controls for 10's, units and decimals of dB.

4–47 Trigger Output Generator (Figure 7–7)

4–48 The trigger is generated when the diodes CR1 to CR20 sense a high (or low) state at the Q (or the Q) outputs of the first 20 flip-flops. Therefore, at a particular shift register content (paragraph 4–37), the bia of Q19 becomes positive via R90, CR21 and CR22 (figure 8–8, sheet 3 of 4), thus opening this transistor and closing Q20. After the clock pulse has shifted the initial word, the positive bias at the base of Q19 is terminated, turning Q19 off and Q20 on, thus ending the trigger pulse.

4–49 Binary Output Amplifier (Figure 7–7)

4–50 With the binary output from stage 31 of the shift register in a low state, Q21 will conduct, keeping Q22 turned off. When the situation changes to high output, the voltage at R60 is clamped by the emitter base diode of Q22, and Q22 conducts.

4–51 Automatic Start Logic (Figure 7–5)

4–52 The automatic start circuit Q34/Q35 prevents the instrument from being disabled at switch-on by the shift register holding 32 zeroes.

4–53 The capacitor C2 is charged by Q34 via R94. When the voltage across C2 has reached the threshold of the uni-junction transistor Q35, it discharges through the network Q35, R95, CR23 and R98 and thus reduces the emitter current of Q36. Q37 is turned on, sending a short reset pulse to the shift register.

4–54 Clock Generator (Figure 7–5)

4–55 The clock pulse is generated by the relaxation oscillator Q39 and Q41. Suppose that Q39 and Q41 are both off. C3 is then charged by Q40 at a constant rate, causing the junction of C3 and CR27 to fall towards the negative supply voltage. Consequently, the base emitter voltage of Q39 increases above the threshold and Q39 begins to conduct. As it does so, the base potential of Q41 falls and positive feedback is applied to the base of Q39; this results in both transistors being turned on rapidly.

4–56 A low impedance path now exists between the negative (top)end of C3 and the positive supply. C3 discharges rapidly causing the base emitter voltage of Q39 to fall below threshold. The trigger is a regenerative process in which both transistors are turned off rapidly. Pulse shaping is accomplished by the Schmitt trigger Q44 to Q46.

4–57 To operate from an external trigger, the clock generator is stopped by a negative potential applied from the voltage divider R112, CR30 and R113 via the rear panel INT/EXT switch to the base of Q39. Thus the voltage at C3 is clamped by the diodes CR28 and CR29 holding Q39 off. When a positive trigger signal is applied to J4, the Schmitt Trigger, (Q42/Q43), sends a short positive pulse (shaped by L1 and R117) via CR31 to the base of Q39 initiating one generator cycle. R107 is switched in parallel with R106 so that the charging current for C3 is increased thus permitting triggering frequencies up to 1 MHz. Note that, the pink output has the same RMS level as the white output and that consequently, the peak pink level is higher. Operation at clock frequencies other than the internal rate of 520 kHz can, therefore, lead to saturation of the amplifier. The external trigger, then, should not be used when pink noise is required.

4–58 Gate (Figure 7–5)

4–59 With the "Gate Input" grounded or in a low state (–1V to +2.8V) Q36, Q37 and Q38 are turned on, Q38 draws the current from Q40, hence the clock generator is stopped, and Q37 holds all 32 shift register flip-flops in a particular state (paragraph 4–44). Thus, when the gate voltage goes high, the shift register recommences from a particular state. The appropriate waveforms are shown in Figure 4–10.

4–60 Power Supply

4–61 The power supply assembly A1 provides the necessary operating voltages for the noise generator circuits. Since both the 15 volts positive and the 15volt negative circuits are similar, only the positive circuit will be described.

4–62 Rectifiers CR1 to CR4 supply the unregulated voltage to the regulator circuit. Transistors Q5 and Q6 make up to the differential amplifier which com – pares the line voltage level (adjustable by R10) to the reference voltage at CR6. Any variation of the +15 volt output is sensed by Q5 and Q6 to produce an error signal which is amplified by Q3 and Q1.

4–63 The current limiter Q4 is turned off under normal working conditions. Should the load current exceed 460mA, Q4 will be turned on by the voltage drop across R4. When Q4 turns on, Q1 and Q2 are turned off.

4–64 The shift register requires a potential difference of 5V, but, to allow proper operation of the summing amplifier circuit, the potential must be biased so that its return is at +10 volts. This is achieved by connecting the positive end of the potential difference established by Q12 to Q14 to the +15V line.

5–1 INTRODUCTION

5–2 The following information is presented in this section:

a. Testing and Troubleshooting

b. Removal and replacement of covers

c. Recommended Test Equipment

5–3 TESTING

5–4 The performance checks described in the following tables are independent procedures which are intended to verify that the instrument is operating in accordance with the specification stated in table 1–1. These test procedures can also be used as a guide for troubleshooting in conjunction with figures 5–1 and 5–2. A list of recommended equipment required to test the 8057A appears in table 5–1.

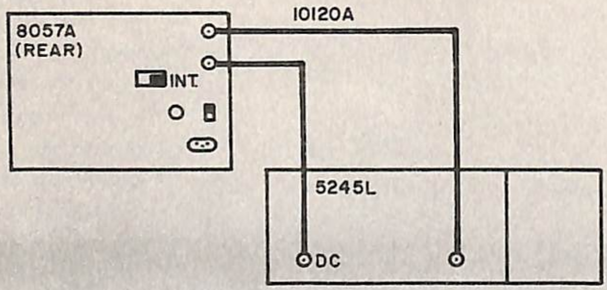
5–5 INSTRUMENT COVER REMOVAL

5–6 The top, bottom and side covers can be separately removed to gain access to all assemblies. Each cover is secured by screws which are threaded into fasteners attached to the instrument castings.

Table 5–1 Test Equipment

Instrument	Minimal Requirements	Model Recommended
Pulse Generator	Pulse rate: 1 MHz Pulse width: 30 nS Amplitude: 0 to + 5 V	HP 8003A
Counter	Max.frequency: 1 MHz Ext. time: 1 MHz Base facility: 1 MHz Sensitivity: 1 V	HP 5254L
Oscilloscope	Max.trig.freq.: 20 MHz Sweep time: 20 nS Freq.range: dc to 20 MHz Sensitivity: 0.1 V/cm	HP 140A with plug-ins HP 1423A and HP 1402A
Wave Analyzer	Bandwidth: ± 25 Hz Rejection: 50 dB	HP 302A

Table 5–2. Performance Check: Sequence Length



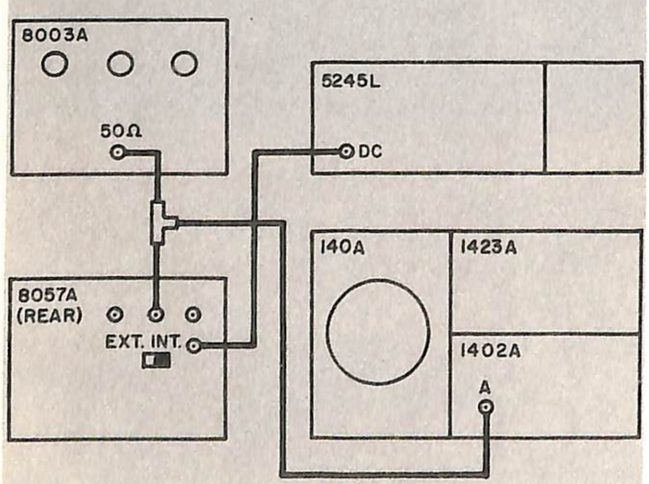
Set controls as follows:

8057A	CLOCK SELECTOR SWITCH	INT.
5245L	PERIOD AVERAGE RANGE	x 1
	TIME BASE	EXT.
	SENSITIVITY	1 volt rms.

5345L display should read:

$$262{,}144 = \frac{\text{sequence length} + 1}{4}$$

Table 5–3. Performance Check: Clock Frequency



INTERNAL OPERATION

Set controls as follows:

8057A	CLOCK SELECTOR SWITCH	INT
5245L	FUNCTION	Period av. range x 1
	TIME BASE	1 mS
	SENSITIVITY	1 volt rms.

5245L should indicate: 2016 mS ± 20 mS

EXTERNAL OPERATION

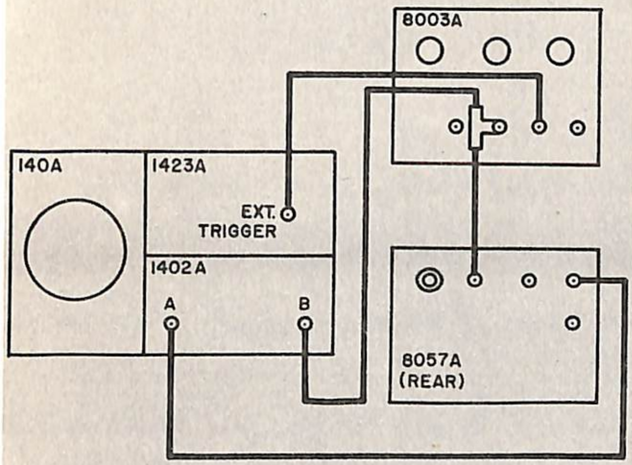
Set controls as follows:

8057A	CLOCK SELECTOR SWITCH	EXT.
8003A	REP RATE SELECTOR	10 MHz
	REP RATE VERNIER (Do not exceed 1 MHz)	CCW
	PULSE WIDTH SELECTOR	30 nS
	PULSE WIDTH VERNIER	CCW
	AMPLITUDE	5 V
1420A	TRIGGER	INT +
	MAGNIFIER	x 1
	SWEEP TIME	0.5 μS
1402A	FUNCTION	A
	POLARITY	+
	CH. A INPUT	ON
	CH. A COUPLING	DC
	CH. A SENSITIVITY	0.5 V/cm
5245L	FUNCTION	Period av. range x 1
	TIME BASE	1 mS
	SENSITIVITY	1 volt rms.

The 5245L reading should correspond to the following:

Trigger pulse period: $T = \dfrac{1{,}048{,}575}{\text{trigger freq.}}$

Table 5–4. Performance Check: Gated Operation

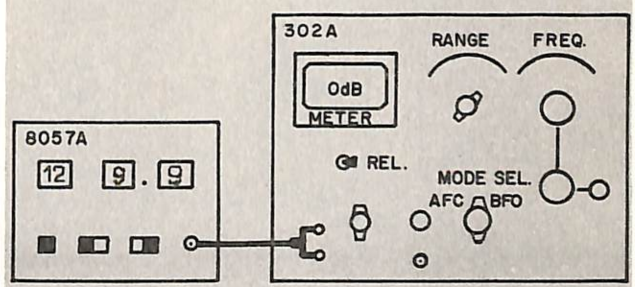


Set controls as follows:

8057A	CLOCK SELECTOR SWITCH	INT.
8003A	REP RATE SELECTOR	0.3 MHz
	REP RATE VERNIER	CCW
	PULSE WIDTH SELECTOR	0.1 mS
	PULSE WIDTH VERNIER	CCW
	AMPLITUDE	+ 2.3 volts
1420A	TRIGGER	EXT
	SWEEP TIME	20 μS
1402A	FUNCTION	ALT
	POLARITY	+
	CH. A	5 V/cm
	CH. A COUPLING	DC
	CH. B	1 V/cm
	CH. B COUPLING	DC

Binary output signal should be enabled when the gate amplitude is $>$+4.5 volts and disabled when $<$ +2.8 volts.

Table 5–5. Performance Check: White Noise Linearity



Set controls as follows:

8057A	ATTENUATOR	129.9 dB
	NOISE	WHITE
	IMPEDANCE	600 Ω
	S1 (mounted on assy A2)	T
302A	SCALE VALUE	RELATIVE
	MAX INPUT VOLTAGE	1 volt
	MODE SELECTOR	NORMAL
	FREQUENCY	0 Hz
	RANGE	300 mV

Increase the Wave Analyzer frequency until the meter indicates the first harmonic peak. Frequency reading should be about 500 Hz.

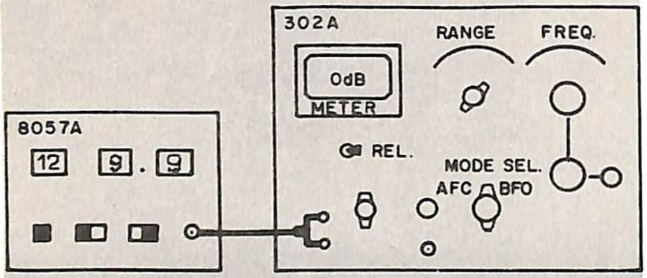
Set MODE SELECTOR SWITCH to AFC. Observe that the meter needle remains on top of the peak and then turn the setting to OdB by means of the MAX. INPUT VOLT. AGE VERNIER.

Set MODE SELECTOR to NORMAL. Find the second harmonic by increasing the Wave Analyzer frequency until the next peak causes a deflection on the meter.

Set MODE SELECTOR to AFC. Meter should now indicate OdB (± 0.3dB). The harmonic spacing should be about 500 Hz.

Continue checking linearity and harmonic spacing up to 27 kHz.

Table 5–6. Performance Check: Pink Noise



Set the controls as follows:

8057A	Noise	PINK
302A	MAX. INPUT VOLTAGE	3 volts
	SCALE VALUE	RELATIVE
	MODE SELECTOR	NORMAL
	FREQUENCY	0 Hz
	RANGE	300 mV

Increase the Wave Analyzer frequency until the meter indicates the first harmonic peak. Frequency reading should be about 500 Hz.

Set MODE SELECTOR SWITCH to AFC. Observe that the meter needle remains on top of the peak. Find the second harmonic (first octave). The meter should indicate –3dB (± 0.5dB).

Find fourth harmonic (second octave). Meter should indiçate –6dB (± 0.5dB).

Result:

Harmonic spacing should be about 500 Hz. The spectrum should increase by 3dB per octave (± 0.5dB) up to 15 kHz.

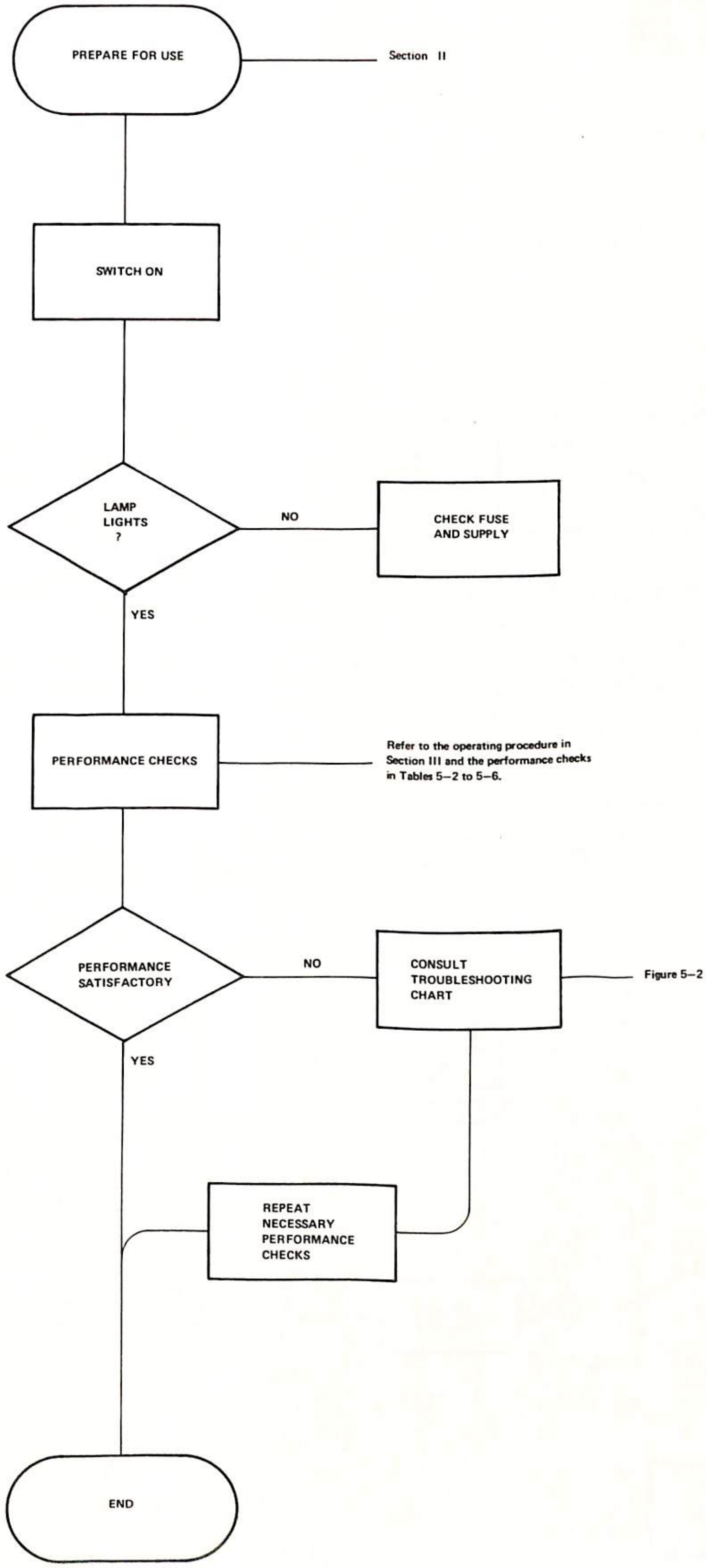


Figure 5–1 Organisation of Tests

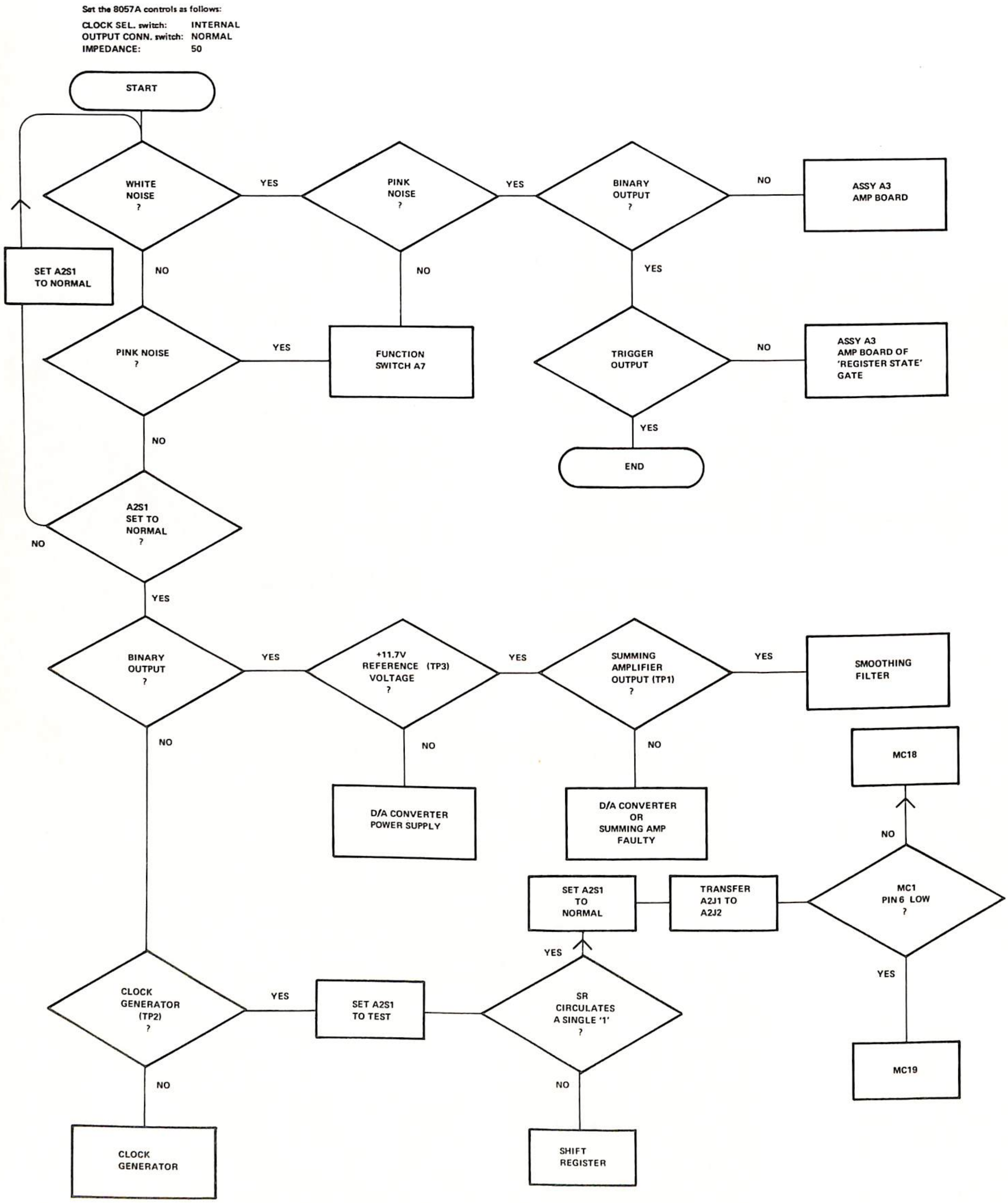


Figure 5–2 Troubleshooting Flow Chart

REPLACEABLE PARTS

6–1 INTRODUCTION

6–2 This section contains information for ordering replacement parts. Table 6–1 lists parts in alpha-numerical order of their reference designators and indicates the description and HP stock number of each part, together with any applicable notes.

6–3 ORDERING INFORMATION

6–4 To order a replacement part, address order of inquiry either to your authorized Hewlett-Packard sales representative or to:

CUSTOMER SERVICE
Hewlett-Packard Company
333 Logue Avenue
Mountain View, California 94040

or, in Western Europe, to:

Hewlett-Packard (Schweiz) SA
Rue du Bois-du-Lan 7
1217 Meyrin 2
Geneva

6–5 Specify the following information for each part:

a) Model and complete serial number of instrument.
b) Hewlett-Packard stock number.
c) Circuit reference designator.
d) Description.

6–6 To order a part not listed in table 6–1 give a complete description of the part and include its function and location.

REFERENCE DESIGNATORS

A	= assembly	F	= fuse	P	= plug	V	= vaccuum tube, neon bulb, photocell, etc.
B	= motor	FL	= filter	Q	= transistor		
BT	= battery	HR	= heater	R	= resistor	VR	= voltage regulator
C	= capacitor	J	= jack	RT	= thermistor	W	= cable
CP	= coupler	K	= relay	S	= switch	X	= socket
CR	= diode	L	= inductor	T	= transformer	Y	= crystal
DL	= delav line	M	= meter	TB	= terminal board		
DS	= lamp	MC	= micro-circuit	TP	= test point		

Table 6–1 Replaceable Parts

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A1	08057-66501	BD AY PS			
A2	08057-66502	BD AY SHFTRGST			
A3	08057-66503	BD AY OUT AMPL			
A4	08057-61901	SW AY STEPATT			
A5	08057-61902	SW AY STEPATT			
A6	08057-61903	SW AY STEPATT			
A7	08057-61904	SW AY PBTN			
C1	0160-2218	C-F .001UF 300V			
DS1	2140-0008	LAMP NEON 115V			
F1	2110-0201	FUSE .25 FER			
F1	2110-0318	FUSE .125 FER			
J1	1250-0118	CONN BNC BLKHD			
J2	1250-0118	SAME AS J 1			
J3	1250-0118	SAME AS J 1			
J4	1250-0118	SAME AS J 1			
J5	1250-0118	SAME AS J 1			
J6	1251-2165	CONN 5F RECEP			
J7	1251-2357	CONN PWR AC RECE			
R1	0758-0049	R-F 33K5% .25W F			
S1	3101-1235	SW SLIDE DPDT			
S2	3101-1235	SAME AS S 1			
S3	3101-1234	SW SLIDE DPDT			
T1	5080-0913	XFMRPWR			
W1	8120-1349	PWR CORD SET			

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A1 C1	0180-1723	C-F 500UF 50V			
A1 C2	0180-0196	C-F 56UF 15V			
A1 C3	0180-0197	C-F2.2UF 20V			
A1 C4	0180-0098	C-F 100UF 20V			
A1 C5	0180-1723	C-F 500UF 50V			
A1 C6	0180-0196	C-F 56UF 15V			
A1 C7	0180-0197	C-F2.2UF 20V			
A1 C8	0180-0098	C-F 100UF 20V			
A1 C9	0180-0237	C-F 500UF 25V			
A1 C10	0150-0096	C-F .05UF 100V			
A1 C11	0180-0137	C-F 100UF 10V			
A1 C12	0180-0212	C-F 250UF 12V			
A1 C13	0160-2147	C-F .025UF 100V			
A1 C14	0160-2147	C-F .025UF 100V			
A1 CR1	1901-0194	DIO SI 50V .75A			
A1 CR2	1901-0194	DIO SI 50V .75A			
A1 CR3	1901-0194	DIO SI 50V .75A			
A1 CR4	1901-0194	DIO SI 50V .75A			
A1 CR5	1902-3107	DIO BKDN 5.76 V			
A1 CR6	1902-0041	DIO BKDN 5.11 V			
A1 CR7	1901-0194	DIO SI 50V .75A			
A1 CR8	1901-0194	DIO SI 50V .75A			
A1 CR9	1901-0194	DIO SI 50V .75A			
A1 CR10	1901-0194	DIO SI 50V .75A			
A1 CR11	1902-3107	DIO BKDN 5.76 V			
A1 CR12	1902-0041	DIO BKDN 5.11 V			
A1 CR13	1901-0194	DIO SI 50V .75A			
A1 CR14	1901-0194	DIO SI 50V .75A			
A1 CR15	1901-0194	DIO SI 50V .75A			
A1 CR16	1901-0194	DIO SI 50V .75A			
A1 CR17	1902-0188	DIO BKDN 4.12 V			
A1 J1	1251-0213	CONN PC 15 CONT			
A1 J2	1251-1513	CONN PC 18CONT T			
A1 Q1	1854-0022	XSTR SI NPN			
A1 Q2	1854-0072	XSTR 2N3054 SI			
A1 Q3	1854-0329	XSTR SI NPN			
A1 Q4	1854-0329	XSTR SI NPN			
A1 Q5	1854-0307	XSTR SI NPN			
A1 Q6	1854-0307	XSTR SI NPN			
A1 Q7	1854-0022	XSTR SI NPN			
A1 Q8	1854-0072	XSTR 2N3054 SI			
A1 Q9	1854-0329	XSTR SI NPN			
A1 Q10	1854-0307	XSTR SI NPN			
A1 Q11	1854-0307	XSTR SI NPN			
A1 Q12	1854-0307	XSTR SI NPN			
A1 Q13	1854-0072	XSTR 2N3054 SI			
A1 Q14	1854-0329	XSTR SI NPN			
A1 Q15	1854-0307	XSTR SI NPN			
A1 Q16	1854-0329	XSTR SI NPN			
A1 R1	0698-4271	R-F 5.1K5% .125W			
A1 R2	0698-4271	R-F 5.1K5% .125W			
A1 R3	0698-4248	R-F 560 5% .125W			
A1 R4	0727-0001	R-F 1.5 2% .5W			
A1 R5	0698-4248	R-F 560 5% .125W			
A1 R6	0698-4290	R-F 33K5% .125W			
A1 R7	0698-4282	R-F 15K5% .125W			
A1 R8	0698-4290	R-F 33K5% .125W			
A1 R9	0698-4253	R-F 910 5% .125W			
A1 R10	2100-2739	R-VAR 220 2W CER			
A1 R11	0698-4245	R-F 390 5% .125W			
A1 R12	0698-4271	R-F 5.1K5% .125W			
A1 R13	0698-4271	R-F 5.1K5% .125W			
A1 R14	0698-4248	R-F 560 5% .125W			
A1 R15	0698-4248	R-F 560 5% .125W			
A1 R16	0698-4290	R-F 33K5% .125W			
A1 R17	0698-4282	R-F 15K5% .125W			
A1 R18	0698-4290	R-F 33K5% .125W			
A1 R19	0698-4253	R-F 910 5% .125W			
A1 R20	2100-2739	R-VAR 220 2W CER			
A1 R21	0698-4245	R-F 390 5% .125W			
A1 R22	0698-4235	R-F 150 5% .125W			
A1 R23	0698-4271	R-F 5.1K5% .125W			
A1 R24	0698-4271	R-F 5.1K5% .125W			
A1 R25	0727-0001	R-F 1.5 2% .5W			
A1 R26	0758-0124	R-F 51 5% .125W			
A1 R27	0698-6744	R-F 20 5% .125W			
A1 R28	2100-2796	R-VAR 100 .5W			
A1 R29	0698-4245	R-F 390 5% .125W			
A1 R30	0698-4258	R-F 1.5K5% .125W			
A1 R32	0727-0001	R-F 1.5 2% .5W			
A1 RT1	0837-0015	THMS 50C DISC			

Table 6–1. Replaceable Parts (cont'd)

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A2 C2	0180-1746	C-F 15UF 20V			
A2 C3	0140-0157	C-F .001857UF			
A2 C4	0160-0153	C-F .001UF 200V			
A2 C5	0160-2265	C-F 22PF 500V			
A2 C6	0160-0174	C-F .47UF 25V			
A2 C7	0150-0121	C-F .1UF 50V			
A2 C8	0180-0197	C-F2.2UF 20V			
A2 C9	0180-0197	C-F2.2UF 20V			
A2 C10	0140-0196	C-F 150PF 300V			
A2 CR1	1901-0040	DIO SI 30V .03A			
A2 CR2	1901-0040	DIO SI 30V .03A			
A2 CR3	1901-0040	DIO SI 30V .03A			
A2 CR4	1901-0040	DIO SI 30V .03A			
A2 CR5	1901-0040	DIO SI 30V .03A			
A2 CR6	1901-0040	DIO SI 30V .03A			
A2 CR7	1901-0040	DIO SI 30V .03A			
A2 CR8	1901-0040	DIO SI 30V .03A			
A2 CR9	1901-0040	DIO SI 30V .03A			
A2 CR10	1901-0040	DIO SI 30V .03A			
A2 CR11	1901-0040	DIO SI 30V .03A			
A2 CR12	1901-0040	DIO SI 30V .03A			
A2 CR13	1901-0040	DIO SI 30V .03A			
A2 CR14	1901-0040	DIO SI 30V .03A			
A2 CR15	1901-0040	DIO SI 30V .03A			
A2 CR16	1901-0040	DIO SI 30V .03A			
A2 CR17	1901-0040	DIO SI 30V .03A			
A2 CR18	1901-0040	DIO SI 30V .03A			
A2 CR19	1901-0040	DIO SI 30V .03A			
A2 CR20	1901-0040	DIO SI 30V .03A			
A2 CR21	1901-0040	DIO SI 30V .03A			
A2 CR22	1901-0040	DIO SI 30V .03A			
A2 CR23	1901-0040	DIO SI 30V .03A			
A2 CR24	1901-0040	DIO SI 30V .03A			
A2 CR25	1901-0040	DIO SI 30V .03A			
A2 CR26	1910-0034	DIO-GE 25V .1A			
A2 CR27	1901-0040	DIO SI 30V .03A			
A2 CR28	1901-0040	DIO SI 30V .03A			
A2 CR29	1901-0040	DIO SI 30V .03A			
A2 CR30	1901-0040	DIO SI 30V .03A			
A2 CR31	1901-0040	DIO SI 30V .03A			
A2 CR32	1901-0040	DIO SI 30V .03A			
A2 CR33	1901-0040	DIO SI 30V .03A			
A2 CR34	1901-0040	DIO SI 30V .03A			
A2 CR35	1901-0040	DIO SI 30V .03A			
A2 L1	9140-0111	COIL-CHOKE 3.3UH			
A2 MC1	1820-0077	IC 7474N EQUIV			
A2 MC2	1820-0077	IC 7474N EQUIV			
A2 MC3	1820-0077	IC 7474N EQUIV			
A2 MC4	1820-0077	IC 7474N EQUIV			
A2 MC5	1820-0077	IC 7474N EQUIV			
A2 MC6	1820-0077	IC 7474N EQUIV			
A2 MC7	1820-0077	IC 7474N EQUIV			
A2 MC8	1820-0077	IC 7474N EQUIV			
A2 MC9	1820-0077	IC 7474N EQUIV			
A2 MC10	1820-0077	IC 7474N EQUIV			
A2 MC11	1820-0077	IC 7474N EQUIV			
A2 MC12	1820-0077	IC 7474N EQUIV			
A2 MC13	1820-0077	IC 7474N EQUIV			
A2 MC14	1820-0077	IC 7474N EQUIV			
A2 MC15	1820-0077	IC 7474N EQUIV			
A2 MC16	1820-0077	IC 7474N EQUIV			
A2 MC17	1820-0063	IC 7451N EQUIV			
A2 MC18	1820-0054	IC 7400N EQUIV			
A2 MC19	1820-0054	IC 7400N EQUIV			
A2 Q1	1853-0229	XSTR SI PNP			
A2 Q2	1853-0229	XSTR SI PNP			
A2 Q3	1853-0229	XSTR SI PNP			
A2 Q4	1853-0229	XSTR SI PNP			
A2 Q5	1853-0229	XSTR SI PNP			
A2 Q6	1853-0229	XSTR SI PNP			
A2 Q7	1853-0229	XSTR SI PNP			
A2 Q8	1853-0229	XSTR SI PNP			
A2 Q9	1853-0229	XSTR SI PNP			
A2 Q10	1853-0229	XSTR SI PNP			
A2 Q11	1853-0229	XSTR SI PNP			
A2 Q12	1853-0229	XSTR SI PNP			
A2 Q13	1853-0229	XSTR SI PNP			
A2 Q14	1853-0229	XSTR SI PNP			
A2 Q15	1853-0229	XSTR SI PNP			
A2 Q16	1853-0229	XSTR SI PNP			
A2 Q17	1853-0229	XSTR SI PNP			
A2 Q18	1853-0229	XSTR SI PNP			
A2 Q19	1853-0229	XSTR SI PNP			
A2 Q20	1853-0229	XSTR SI PNP			
A2 Q21	1853-0229	XSTR SI PNP			
A2 Q22	1853-0229	XSTR SI PNP			
A2 Q23	1853-0229	XSTR SI PNP			
A2 Q24	1853-0229	XSTR SI PNP			
A2 Q25	1853-0229	XSTR SI PNP			
A2 Q26	1853-0229	XSTR SI PNP			
A2 Q27	1853-0229	XSTR SI PNP			
A2 Q28	1853-0229	XSTR SI PNP			
A2 Q29	1853-0229	XSTR SI PNP			
A2 Q30	1853-0229	XSTR SI PNP			
A2 Q34	1853-0090	XSTR SI PNP			
A2 Q35	1855-0012	XSTR 2N2646 UJ			
A2 Q36	1854-0307	XSTR SI NPN			
A2 Q37	1854-0307	XSTR SI NPN			
A2 Q38	1853-0090	XSTR SI PNP			
A2 Q39	1854-0019	XSTR SI NPN			
A2 Q40	1854-0329	XSTR SI NPN			
A2 Q41	1853-0036	XSTR SI PNP			
A2 Q42	1854-0307	XSTR SI NPN			
A2 Q43	1854-0307	XSTR SI NPN			
A2 Q44	1854-0019	XSTR SI NPN			
A2 Q45	1854-0019	XSTR SI NPN			
A2 Q46	1854-0019	XSTR SI NPN			
A2 R1	0698-4257	R-F 1.3K5% .125W			
A2 R2	0698-4257	R-F 1.3K5% .125W			
A2 R3	0698-4257	R-F 1.3K5% .125W			
A2 R4	0698-4257	R-F 1.3K5% .125W			
A2 R5	0698-4257	R-F 1.3K5% .125W			
A2 R6	0698-4257	R-F 1.3K5% .125W			
A2 R7	0698-4257	R-F 1.3K5% .125W			
A2 R8	0698-4257	R-F 1.3K5% .125W			
A2 R9	0698-4257	R-F 1.3K5% .125W			
A2 R10	0698-4257	R-F 1.3K5% .125W			
A2 R11	0698-4257	R-F 1.3K5% .125W			
A2 R12	0698-4257	R-F 1.3K5% .125W			
A2 R13	0698-4257	R-F 1.3K5% .125W			
A2 R14	0698-4257	R-F 1.3K5% .125W			
A2 R15	0698-4257	R-F 1.3K5% .125W			
A2 R16	0698-4257	R-F 1.3K5% .125W			
A2 R17	0698-4257	R-F 1.3K5% .125W			
A2 R18	0698-4257	R-F 1.3K5% .125W			
A2 R19	0698-4257	R-F 1.3K5% .125W			
A2 R20	0698-4257	R-F 1.3K5% .125W			
A2 R21	0698-4257	R-F 1.3K5% .125W			
A2 R22	0698-4257	R-F 1.3K5% .125W			
A2 R23	0698-4257	R-F 1.3K5% .125W			
A2 R24	0698-4257	R-F 1.3K5% .125W			
A2 R25	0698-4257	R-F 1.3K5% .125W			
A2 R26	0698-4257	R-F 1.3K5% .125W			
A2 R27	0698-4257	R-F 1.3K5% .125W			
A2 R28	0698-4257	R-F 1.3K5% .125W			
A2 R29	0698-4257	R-F 1.3K5% .125W			
A2 R30	0698-4257	R-F 1.3K5% .125W			
A2 R31	0757-0484	R-F 619K1% .125W			
A2 R32	0698-4278	R-F 10K5% .125W			
A2 R33	0698-4278	R-F 10K5% .125W			
A2 R34	0698-5797	R-F 296K 1% .125			
A2 R35	0698-5796	R-F 186K 1% .125			
A2 R36	0698-4278	R-F 10K5% .125W			
A2 R37	0698-4278	R-F 10K5% .125W			
A2 R38	0698-5795	R-F 138K.5%			
A2 R39	0757-0467	R-F 121K1% .125W			
A2 R40	0698-4278	R-F 10K5% .125W			
A2 R41	0698-4278	R-F 10K5% .125W			
A2 R42	0757-0469	R-F 150K1% .125W			
A2 R43	0757-0472	R-F 200K1% .125W			
A2 R44	0698-4278	R-F 10K5% .125W			
A2 R45	0757-0467	R-F 121K1% .125W			
A2 R46	0698-4278	R-F 10K5% .125W			
A2 R47	0698-4278	R-F 10K5% .125W			
A2 R48	0698-5794	R-F 52.6K.5%			
A2 R49	0698-5793	R-F 31.1K.5%			
A2 R50	0698-4282	R-F 15K5% .125W			
A2 R51	0698-4284	R-F 18K5% .125W			
A2 R52	0698-6888	R-F 21.3K.5%			
A2 R53	0698-6880	R-F 16K.5% .125W			
A2 R54	0698-4288	R-F 27K5% .125W			
A2 R55	0698-6877	R-F 12.9K.5%			
A2 R56	0698-5789	R-F 11.1K.5%			
A2 R57	0698-6871	R-F 10K.5% .125W			
A2 R58	0698-6871	R-F 10K.5% .125W			
A2 R59	0698-5789	R-F 11.1K.5%			
A2 R60	0698-6877	R-F 12.9K.5%			
A2 R61	0698-4288	R-F 27K5% .125W			
A2 R62	0698-6880	R-F 16K.5% .125W			
A2 R63	0698-4284	R-F 18K5% .125W			
A2 R64	0698-6888	R-F 21.3K.5%			
A2 R65	0698-4282	R-F 15K5% .125W			
A2 R66	0698-5793	R-F 31.1K.5%			
A2 R67	0698-4278	R-F 10K5% .125W			
A2 R68	0698-5794	R-F 52.6K.5%			
A2 R69	0698-4278	R-F 10K5% .125W			
A2 R70	0757-0467	R-F 121K1% .125W			

Table 6–1. Replaceable Parts (cont'd)

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A2 R71	0698-4278	R-F 10K5% .125W			
A2 R72	0757-0472	R-F 200K1% .125W			
A2 R73	0757-0469	R-F 150K1% .125W			
A2 R74	0698-4278	R-F 10K5% .125W			
A2 R75	0698-4278	R-F 10K5% .125W			
A2 R76	0757-0467	R-F 121K1% .125W			
A2 R77	0698-5795	R-F 138K.5%			
A2 R78	0698-4278	R-F 10K5% .125W			
A2 R79	0698-4278	R-F 10K5% .125W			
A2 R80	0698-5796	R-F 186K 1% .125			
A2 R81	0698-5797	R-F 296K 1% .125			
A2 R82	0698-4278	R-F 10K5% .125W			
A2 R83	0698-4278	R-F 10K5% .125W			
A2 R84	0757-0494	R-F 619K1% .125W			
A2 R90	0757-0915	R-F 430 2% .125W			
A2 R92	0698-4254	R-F 1K5% .125W F			
A2 R93	0698-4271	R-F 5.1K5% .125W			
A2 R94	0698-4258	R-F 1.5K5% .125W			
A2 R95	0698-4235	R-F 150 5% .125W			
A2 R96	0758-0124	R-F 51 5% .125W			
A2 R97	0698-4255	R-F 1.1K5% .125W			
A2 R98	0698-4254	R-F 1K5% .125W F			
A2 R99	0698-4271	R-F 5.1K5% .125W			
A2 R100	0698-4265	R-F 3K5% .125W F			
A2 R101	0698-4242	R-F 300 5% .125W			
A2 R102	0757-0437	R-F 4.75K1%			
A2 R103	0757-0438	R-F 5.11K1%			
A2 R104	0698-4264	R-F 2.7K5% .125W			
A2 R105	0757-0915	R-F 430 2% .125W			
A2 R106	0757-0430	R-F 2.21K1%			
A2 R107	0698-4258	R-F 1.5K5% .125W			
A2 R108	0698-4247	R-F 510 5% .125W			
A2 R109	0757-0407	R-F 200 1% .125W			
A2 R110	0698-4252	R-F 820 5% .125W			
A2 R111	0698-4269	R-F 4.3K5% .125W			
A2 R112	0698-4269	R-F 4.3K5% .125W			
A2 R113	0698-4264	R-F 2.7K5% .125W			
A2 R114	0698-4254	R-F 1K5% .125W F			
A2 R115	0757-0430	R-F 2.21K1%			
A2 R116	0757-0273	R-F 3.01K1%			
A2 R117	0757-0915	R-F 430 2% .125W			
A2 R119	0757-0824	R-F 2K1% .5W MF			
A2 R120	0757-0408	R-F 243 1% .125W			
A2 R122	0698-4254	R-F 1K5% .125W F			
A2 R123	0698-4254	R-F 1K5% .125W F			
A2 R124	0698-4259	R-F 1.6K5% .125W			
A2 R125	0698-4254	R-F 1K5% .125W F			
A2 R126	2100-2777	R-VAR 1K .5W			
A2 S1	08057-21901	SW SLID			

Table 6–1. Replaceable Parts (cont'd)

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A3 C1	0160-0153	C-F .001UF 200V			
A3 C2	0160-2257	C-F 10PF 500V			
A3 C3	0180-1743	C-F .1UF 35V			
A3 C4	0160-2228	C-F .0027UF 300V			
A3 C5	0160-2210	C-F 470PF 300V			
A3 C6	0160-2257	C-F 10PF 500V			
A3 C7	0160-0153	C-F .001UF 200V			
A3 C8	0180-1743	C-F .1UF 35V			
A3 C9	0150-0121	C-F .1UF 50V			
A3 C10	0150-0121	C-F .1UF 50V			
A3 C12	0180-0159	C-F 220UF 10V			
A3 C13	0180-0159	C-F 220UF 10V			
A3 C14	0140-0193	C-F 82PF 300V			
A3 C15	0160-2218	C-F .001UF 300V			
A3 C16	0140-0157	C-F .001857UF			
A3 C17	0160-2127	C-F .0046UF 300V			
A3 C18	0160-2151	C-F .011UF 200V			
A3 C19	0160-3385	C-F .03UF 150V			
A3 C20	0160-3384	C-F .072UF 160V			
A3 C21	0160-2194	C-F .18UF 200V			
A3 C22	0160-3383	C-F .430UF 63V			
A3 C23	0160-0542	C-F 1UF 50V			
A3 C24	0150-0121	C-F .1UF 50V			
A3 C26	0160-0174	C-F .47UF 25V			
A3 C27	0180-0197	C-F2.2UF 20V			
A3 C28	0180-0197	C-F2.2UF 20V			
A3 C29	0150-0093	C-F .01UF 100V			
A3 CR1	1901-0040	DIO SI 30V .03A			
A3 CR2	1901-0040	DIO SI 30V .03A			
A3 CR3	1901-0040	DIO SI 30V .03A			
A3 CR4	1901-0040	DIO SI 30V .03A			
A3 J1	1251-0131	CONN TEST POINT			
A3 Q1	1854-0221	XSTR SI NPN			
A3 Q3	1854-0307	XSTR SI NPN			
A3 Q4	1854-0307	XSTR SI NPN			
A3 Q5	1853-0036	XSTR SI PNP			
A3 Q6	1854-0329	XSTR SI NPN			
A3 Q7	1854-0329	XSTR SI NPN			
A3 Q8	1853-0036	XSTR SI PNP			
A3 Q9	1854-0221	XSTR SI NPN			
A3 Q11	1854-0307	XSTR SI NPN			
A3 Q12	1854-0307	XSTR SI NPN			
A3 Q13	1853-0036	XSTR SI PNP			
A3 Q14	1854-0329	XSTR SI NPN			
A3 Q15	1854-0329	XSTR SI NPN			
A3 Q16	1853-0036	XSTR SI PNP			
A3 Q17	1853-0027	XSTR SI PNP			
A3 Q18	1854-0090	XSTR SI NPN			
A3 Q19	1854-0019	XSTR SI NPN			
A3 Q20	1854-0019	XSTR SI NPN			
A3 Q21	1853-0034	XSTR SI PNP			
A3 Q22	1853-0034	XSTR SI PNP			
A3 Q23	1853-0090	XSTR SI PNP			
A3 Q24	1854-0307	XSTR SI NPN			
A3 Q25	1853-0090	XSTR SI PNP			
A3 R1	0698-4252	R-F 820 5% .125W			
A3 R2	2100-2787	R-VAR 220 .5W			
A3 R3	0698-0085	R-F 2.61K1%			
A3 R4	0757-0467	R-F 121K1% .125W			
A3 R5	0698-4286	R-F 22K5% .125W			
A3 R6	0698-4306	R-F 150K5% .125W			
A3 R7	0757-0467	R-F 121K1% .125W			
A3 R8	0698-4252	R-F 820 5% .125W			
A3 R10	0698-4305	R-F 130K5% .125W			
A3 R11	0698-4289	R-F 30K5% .125W			
A3 R12	0757-0283	R-F 2K1% .125W F			
A3 R13	0683-3345	R-F 330K5% .25W			
A3 R14	0698-4289	R-F 30K5% .125W			
A3 R15	0698-4263	R-F 2.4K5% .125W			
A3 R16	0698-4263	R-F 2.4K5% .125W			
A3 R17	0698-6802	R-F 10 5% .125W			
A3 R18	0698-6802	R-F 10 5% .125W			
A3 R19	0757-0283	R-F 2K1% .125W F			
A3 R20	0757-0280	R-F 1K1% .125W F			
A3 R23	0698-4252	R-F 820 5% .125W			
A3 R24	0698-4304	R-F 120K5% .125W			
A3 R25	0698-4286	R-F 22K5% .125W			
A3 R26	0698-4306	R-F 150K5% .125W			
A3 R27	0698-4300	R-F 82K5% .125W			
A3 R29	0698-4269	R-F 4.3K5% .125W			
A3 R30	0698-4305	R-F 130K5% .125W			
A3 R31	0698-4289	R-F 30K5% .125W			
A3 R32	0683-3345	R-F 330K5% .25W			
A3 R33	0698-4289	R-F 30K5% .125W			
A3 R34	0698-4263	R-F 2.4K5% .125W			
A3 R35	0698-4263	R-F 2.4K5% .125W			
A3 R36	0698-4231	R-F 91 5% .125W			
A3 R37	0758-0124	R-F 51 5% .125W			
A3 R38	0758-0124	R-F 51 5% .125W			
A3 R39	0698-4231	R-F 91 5% .125W			
A3 R40	0757-0401	R-F 100 1% .125W			
A3 R42	0757-0401	R-F 100 1% .125W			
A3 R43	0698-4097	R-F 94.8 1%			
A3 R44	0757-0411	R-F 332 1% .125W			
A3 R45	0698-6229	R-F 870 .5%			
A3 R46	0757-0430	R-F 2.21K1%			
A3 R47	0698-7294	R-F 5.55K1%			
A3 R48	0698-7290	R-F 13.8K1%			
A3 R49	0757-0123	R-F 34.8K1%			
A3 R50	0698-7291	R-F 89.6K1%			
A3 R51	0698-7293	R-F 251K1% .25W			
A3 R52	0757-0121	R-F 258K1% .25W			
A3 R53	0698-4248	R-F 560 5% .125W			
A3 R54	0757-0273	R-F 3.01K1%			
A3 R55	0757-0436	R-F 4.32K1%			
A3 R56	0698-4258	R-F 1.5K5% .125W			
A3 R57	0698-4265	R-F 3K5% .125W F			
A3 R60	0757-0407	R-F 200 1% .125W			
A3 R61	0757-0407	R-F 200 1% .125W			
A3 R62	0757-0421	R-F 825 1% .125W			
A3 R63	0698-4256	R-F 1.2K5% .125W			
A3 R64	0698-4256	R-F 1.2K5% .125W			
A3 R65	2100-2787	R-VAR 220 .5W			
A3 R66	0757-0121	R-F 258K1% .25W			
A3 R67	0757-0429	R-F 1.82K1%			
A3 R68	2100-2741	R-VAR 470 2W CER			
A3 R69	0698-4264	R-F 2.7K5% .125W			
A3 R70	2100-2791	R-VAR 100K .5W			
A3 R71	0698-4234	R-F 130 5% .125W			
A3 R72	0757-0424	R-F 1.1K1% .125W			
A3 R73	0757-0435	R-F 3.92K1%			
A3 R74	0698-4263	R-F 2.4K5% .125W			
A3 R75	0698-4235	R-F 150 5% .125W			
A3 R76	0698-4260	R-F 1.8K5% .125W			

REFERENCE DESIGNATOR	H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A4 C1	0160-2144	C-F .0033UF 1KV			
A4 R1	0698-4190	R-F 50 .25%			
A4 R2	0698-5580	R-F 25K.5% .125W			
A4 R3	0698-4190	R-F 50 .25%			
A4 R4	0698-6232	R-F 53.3 .5%			
A4 R5	0698-6230	R-F 790 .5%			
A4 R6	0698-6232	R-F 53.3 .5%			
A4 R7	0698-6233	R-F 61.11 .5%			
A4 R8	0698-6226	R-F 247.5 .5%			
A4 R9	0698-6233	R-F 61.11 .5%			
A4 R10	0698-6235	R-F 96.25 .5%			
A4 R11	0698-6227	R-F 71.16 .5%			
A4 R12	0698-6235	R-F 96.25 .5%			
A4 S1	3100-0518	SW-ROT 5SEC11POS			

Table 6–1. Replaceable Parts (cont'd)

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A5	R1	0757-0284	R-F 150 1% .125W			
A5	R2	0727-0017	R-F 37.35 .5%			
A5	R3	0757-0284	R-F 150 1% .125W			
A5	R4	0698-6236	R-F 292.4 .5%			
A5	R5	0698-6234	R-F 17.61 .5%			
A5	R6	0698-6236	R-F 292.4 .5%			
A5	R7	0698-6237	R-F 436.2 .5%			
A5	R8	0698-6231	R-F 11.61 .5%			
A5	R9	0698-6237	R-F 436.2 .5%			
A5	R10	0698-6229	R-F 870 .5%			
A5	R11	0727-0005	R-F 5.77 .5%			
A5	R12	0698-6229	R-F 870 .5%			
A5	S1	3100-0517	SW-ROT 5SEC10POS			

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A6	C1	0160-2144	C-F .0033UF 1KV			
A6	R1	0698-7292	R-F 1.45K.5%			
A6	R2	0683-0685	R-F 6.8 5% .25W			
A6	R3	0727-0446	R-F 7 1% .5W CF			
A6	R4	0698-7292	R-F 1.45K.5%			
A6	R5	0698-7289	R-F 2.91K.5%			
A6	R6	0811-2108	R-F 1.722 .5%			
A6	R7	0698-7289	R-F 2.91K.5%			
A6	R8	0698-4442	R-F 4.42K1%			
A6	R9	0811-2738	R-F 1.15 .5%			
A6	R10	0698-4442	R-F 4.42K1%			
A6	R11	0698-6206	R-F 8.76K1%			
A6	R12	0811-2738	R-F 1.15 .5%			
A6	R13	0811-2738	R-F 1.15 .5%			
A6	R14	0698-6206	R-F 8.76K1%			
A6	S1	3100-0517	SW-ROT 5SEC10POS			

REFERENCE DESIGNATOR		H-P PART NUMBER	DESCRIPTION	CIRCUIT DIAGRAM SHEET NUMBER	CIRCUIT DIAGRAM GRID REFERENCE	COMPONENT LAYOUT
A7	R1	0698-4265	R-F 3K5% .125W F			
A7	R2	0757-1016	R-F 550 .25% .5W			
A7	S1	3101-0518	SW P-BTN 7SECT			

7–1 INTRODUCTION

7–2 This section contains the block, circuit and component location diagrams necessary for servicing the noise generator. A summary of symbols and references appears in Figure 7–1 and a summary of logic symbols and associated truth tables in Figure 7–2.

7–3 The noise generator consists of seven assemblies (A1 to A7) mounted in a frame. Components mounted on the assemblies are prefixed by the appropriate assembly number, thus A2CR1 is a diode mounted on A2. Components mounted directly on the frame have not prefix. Integrated circuit packages containing more than one functional element are treated separately, each element being identified by a flip-flop designation e. g., MC1 consists of two flip-flops: FF1 and FF2.

7–4 Connections between assemblies are made as follows:

1. Directly by means of flying leads or flying screened leads. These are identified by a colour code.

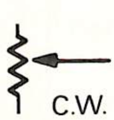
2. Edge connector sockets mounted on the assemblies. Connections between these sockets are made by printed circuitry.

Figure 7–1. General Symbols and References.

NOISE — Typical Front Panel Legend

GATE INPUT — Typical Rear Panel Legend

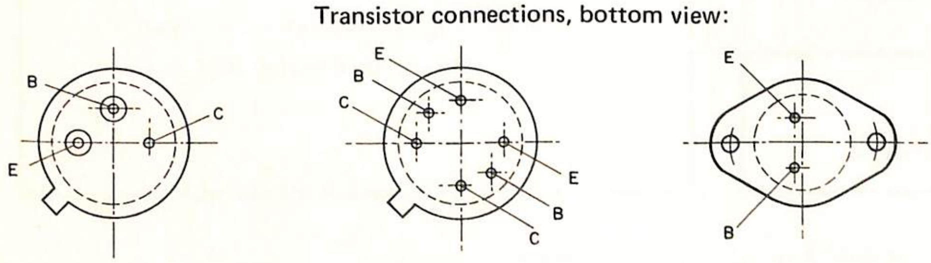
Screwdriver Adjust



Potentiometer. Showing direction to which the contact moves when turned fully CW.

Typical Test Point

Transistor connections, bottom view:



Zener Diode

Colour Code

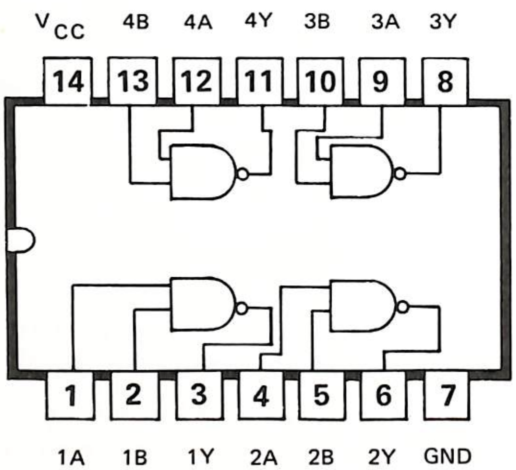
0	Black
1	Brown
2	Red
3	Orange
4	Yellow
5	Green
6	Blue
7	Violet
8	Grey
9	White

Unless otherwise indicated:
capacitance in microfarads
inductance in microhenries
resistance in ohms

*Optimum value selected at factory

1820–0054

QUADRUPLE 2-INPUT POSITIVE NAND GATE

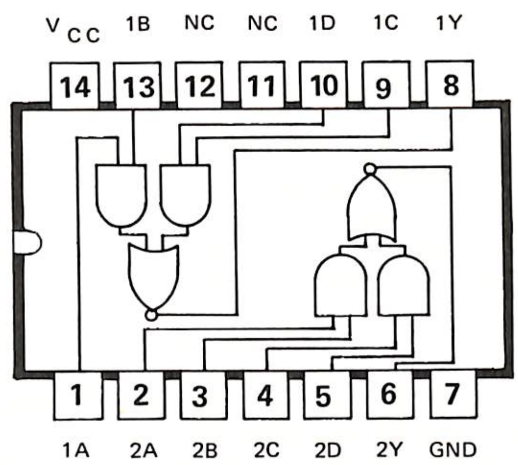


positive logic

$Y = \overline{AB}$

1820–0063

DUAL EXCLUSIVE OR GATE

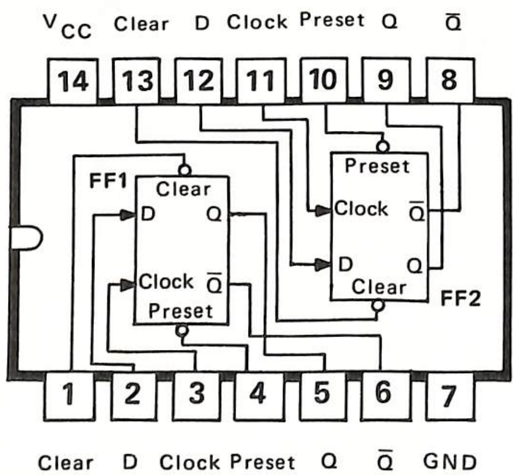


positive logic

$Y = \overline{(AB) + (CD)}$

1820–0077

DUAL D–TYPE EDGE–TRIGGERED FLIP–FLOP



positive logic

a. Low input to clear sets Q to logical 0.
b. Low input to preset sets Q to logical 1.
c. Clear or preset inputs dominate regardless of clock and D inputs.

TRUTH TABLE (Each Flip-Flop)

t_n	t_{n+1}	
INPUT D	**OUTPUT Q**	**OUTPUT $\overline{Q}$**
0	0	1
1	1	0

NOTES: 1. t_n = bit time before clock pulse
2. t_{n+1} = bit time after clock pulse

Figure 7–2 Microcircuit Packages

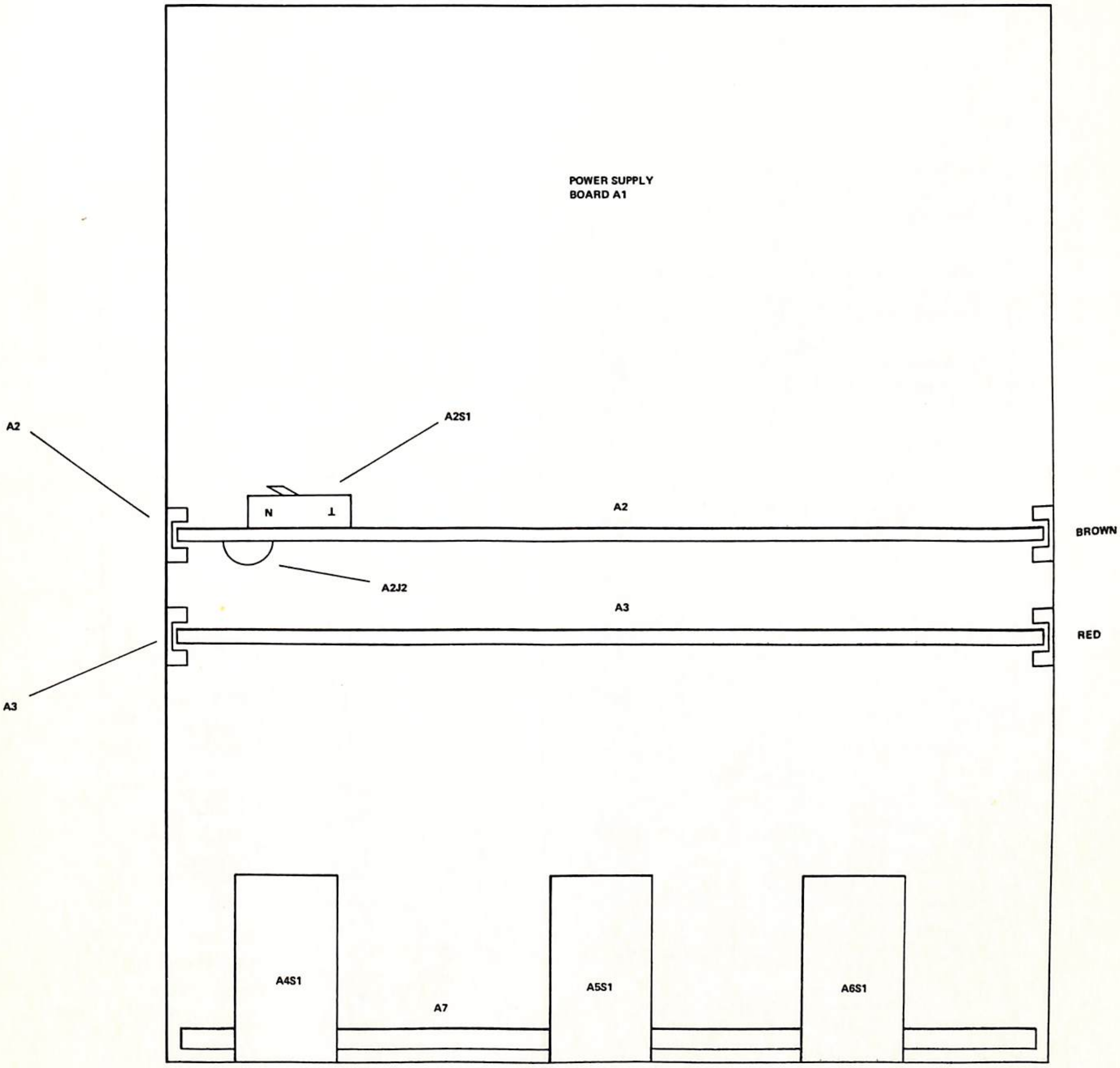
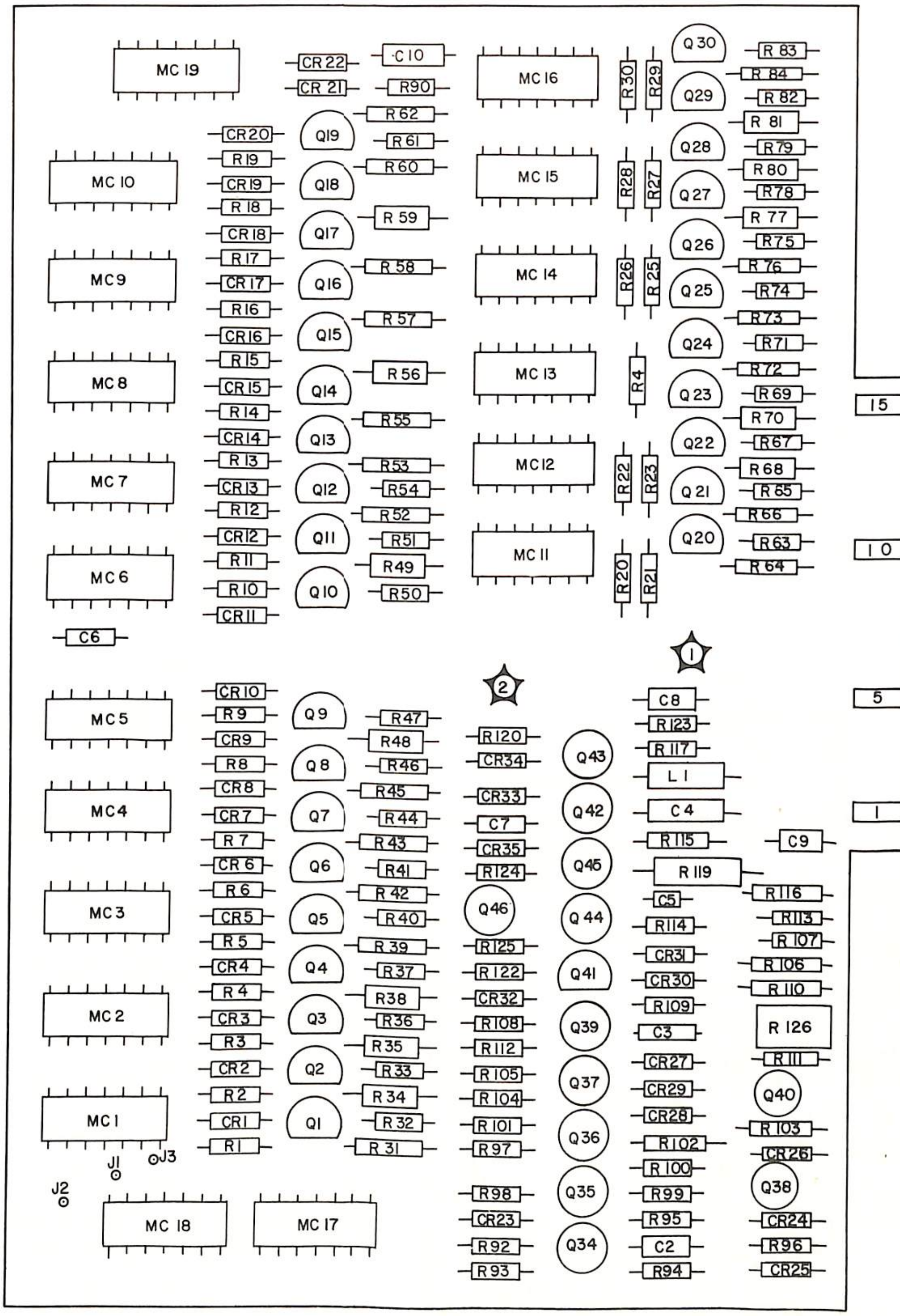


Figure 7—3 Assembly Location



8 057A-A2-3

Figure 7–4 Assembly 2 Component Layout

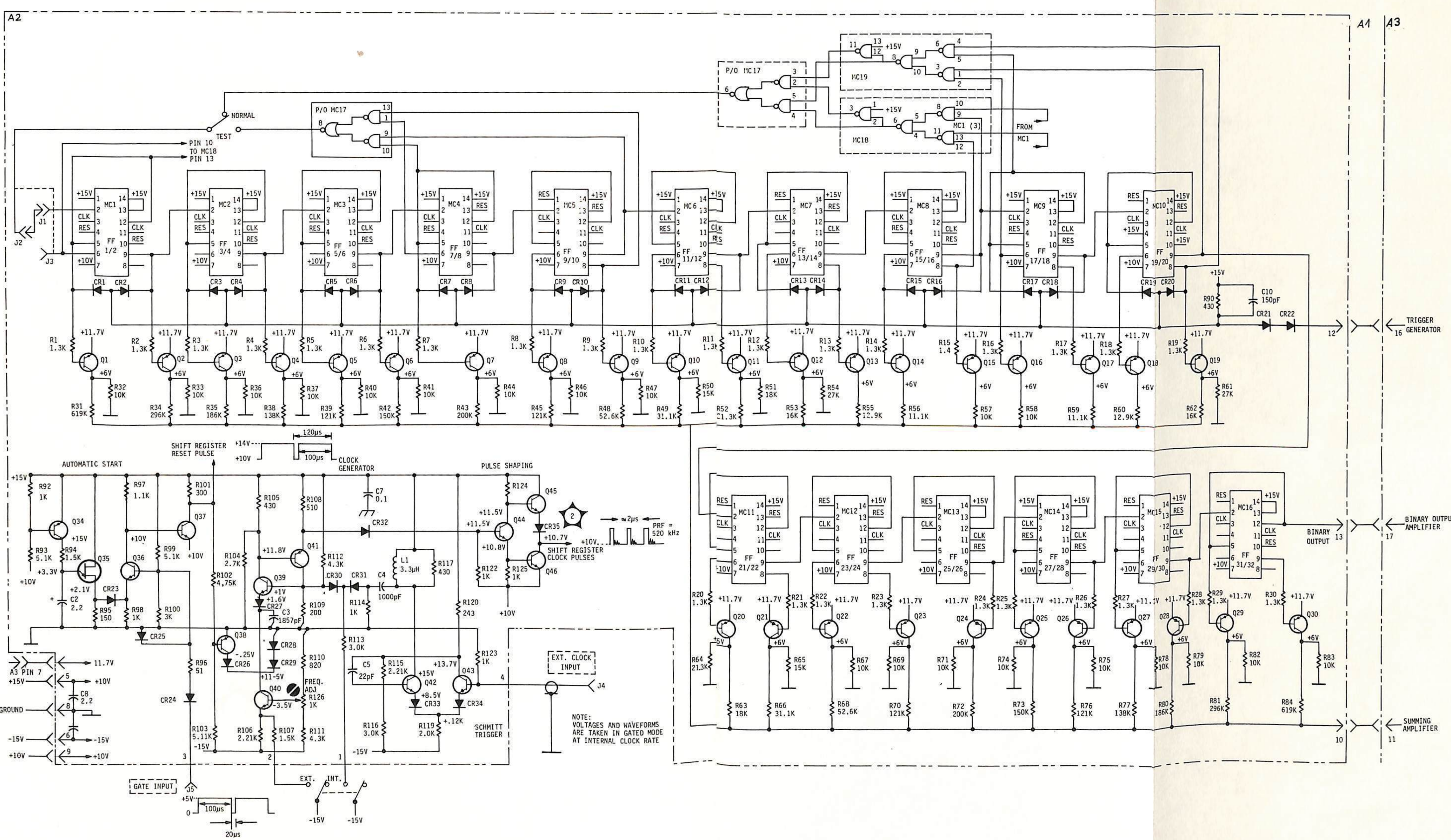


Figure 7–5. Assembly 2 Circuit Diagram

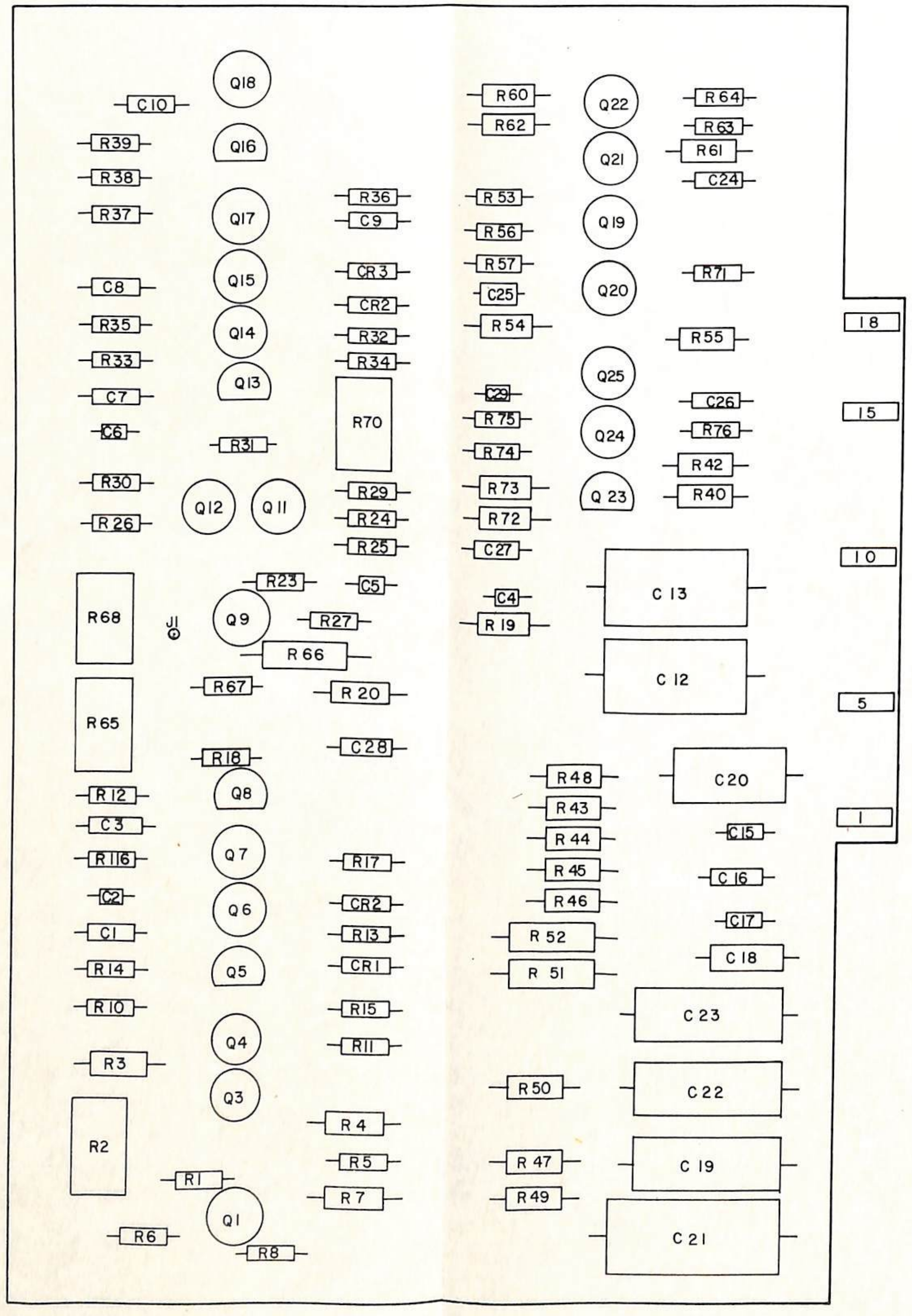
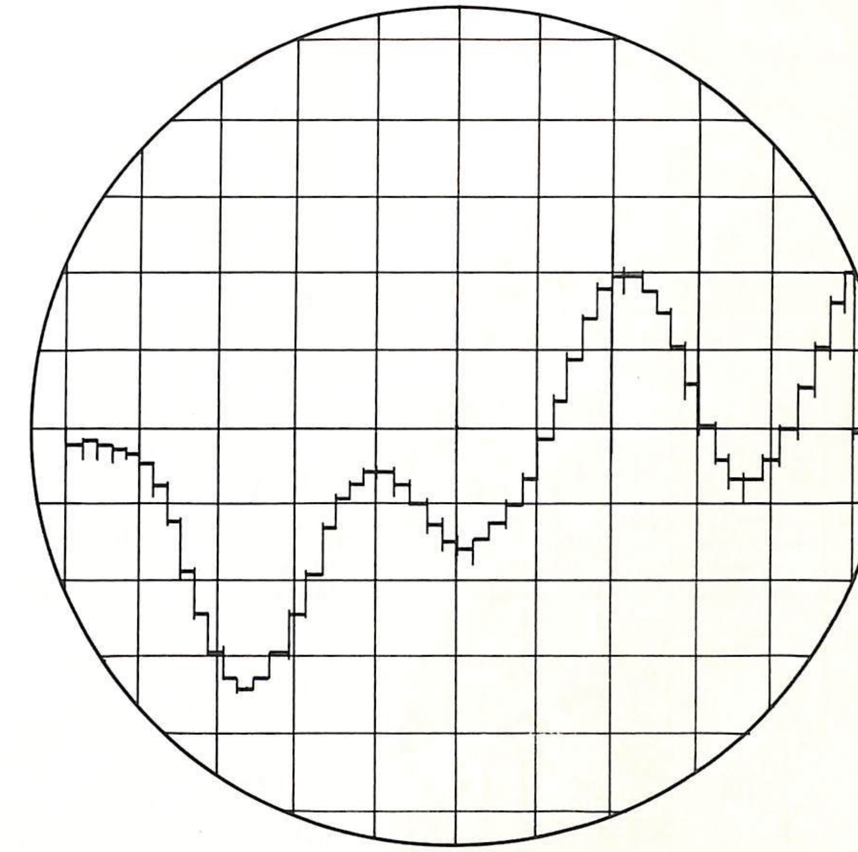
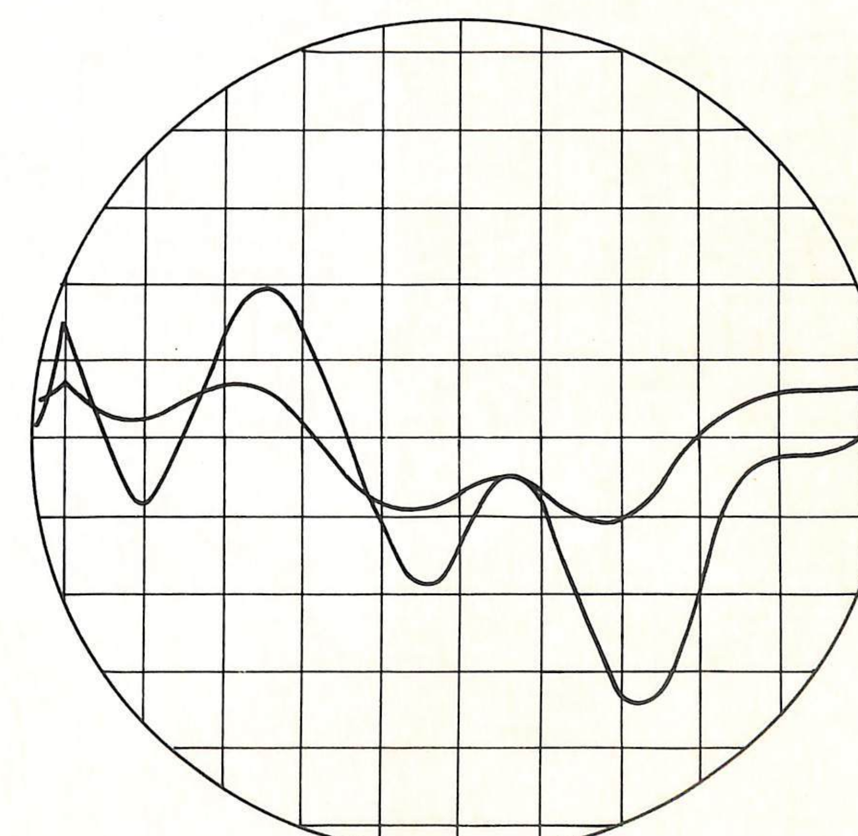


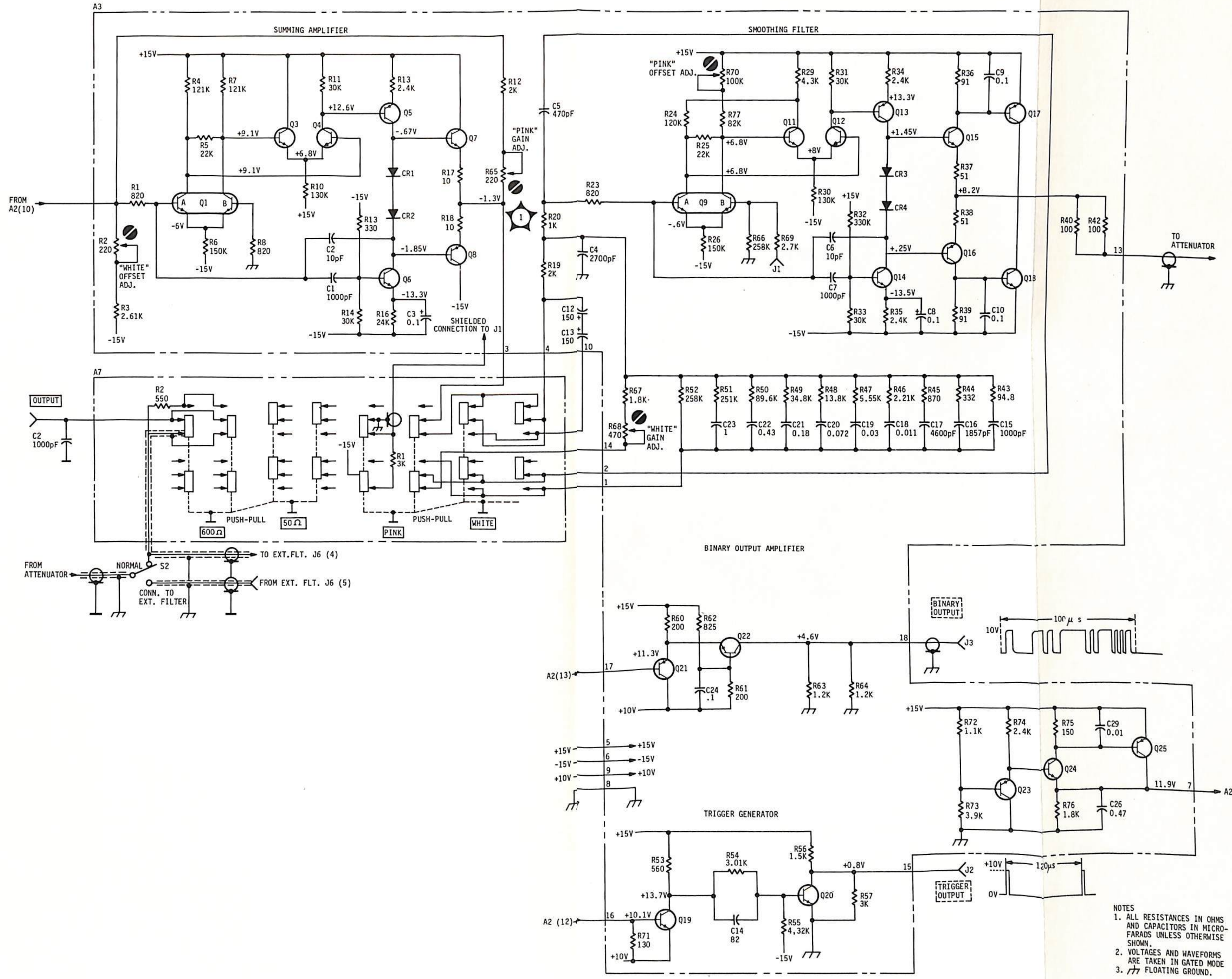
Figure 7–6 Assembly 3 Component Layout and Waveforms



Summing amplifier output (TP1)



Smoothing filter output (pin 13)



NOTES
1. ALL RESISTANCES IN OHMS AND CAPACITORS IN MICRO-FARADS UNLESS OTHERWISE SHOWN.
2. VOLTAGES AND WAVEFORMS ARE TAKEN IN GATED MODE
3. ⏚ FLOATING GROUND.

Figure 7–7 Assemblies 3 and 7 Circuit Diagram

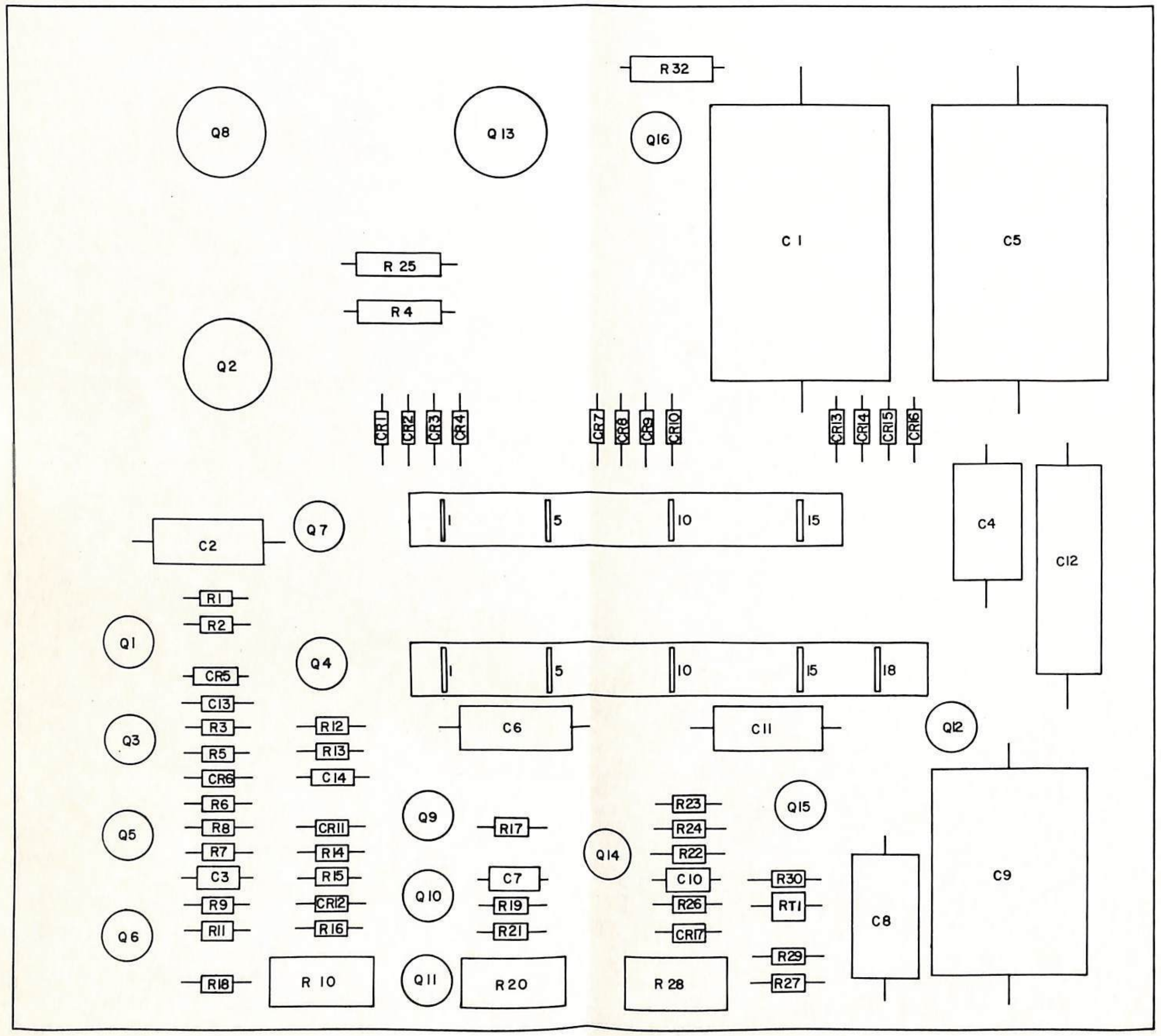


Figure 7–8 Assembly 1 Component Layout

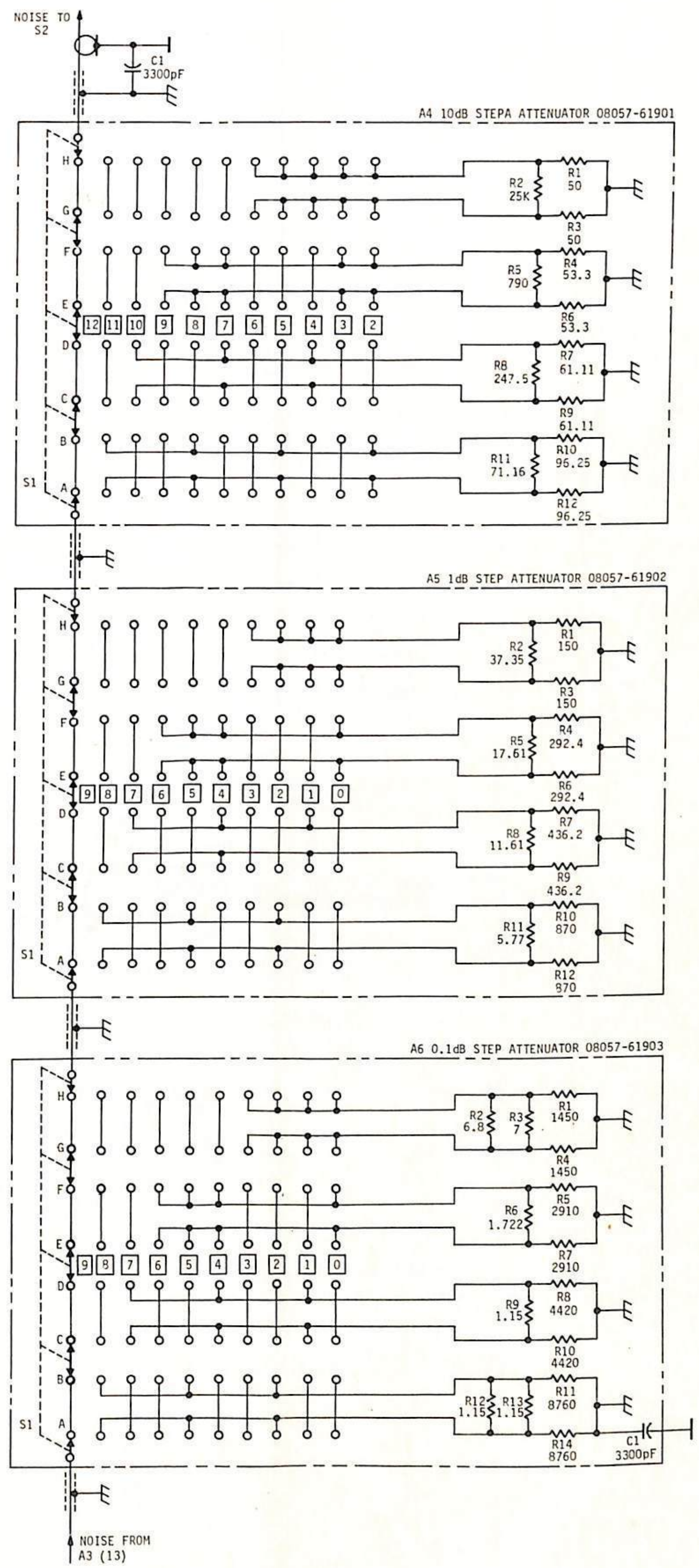


Figure 7–9 Assemblies 4,5 and 6 Circuit Diagram

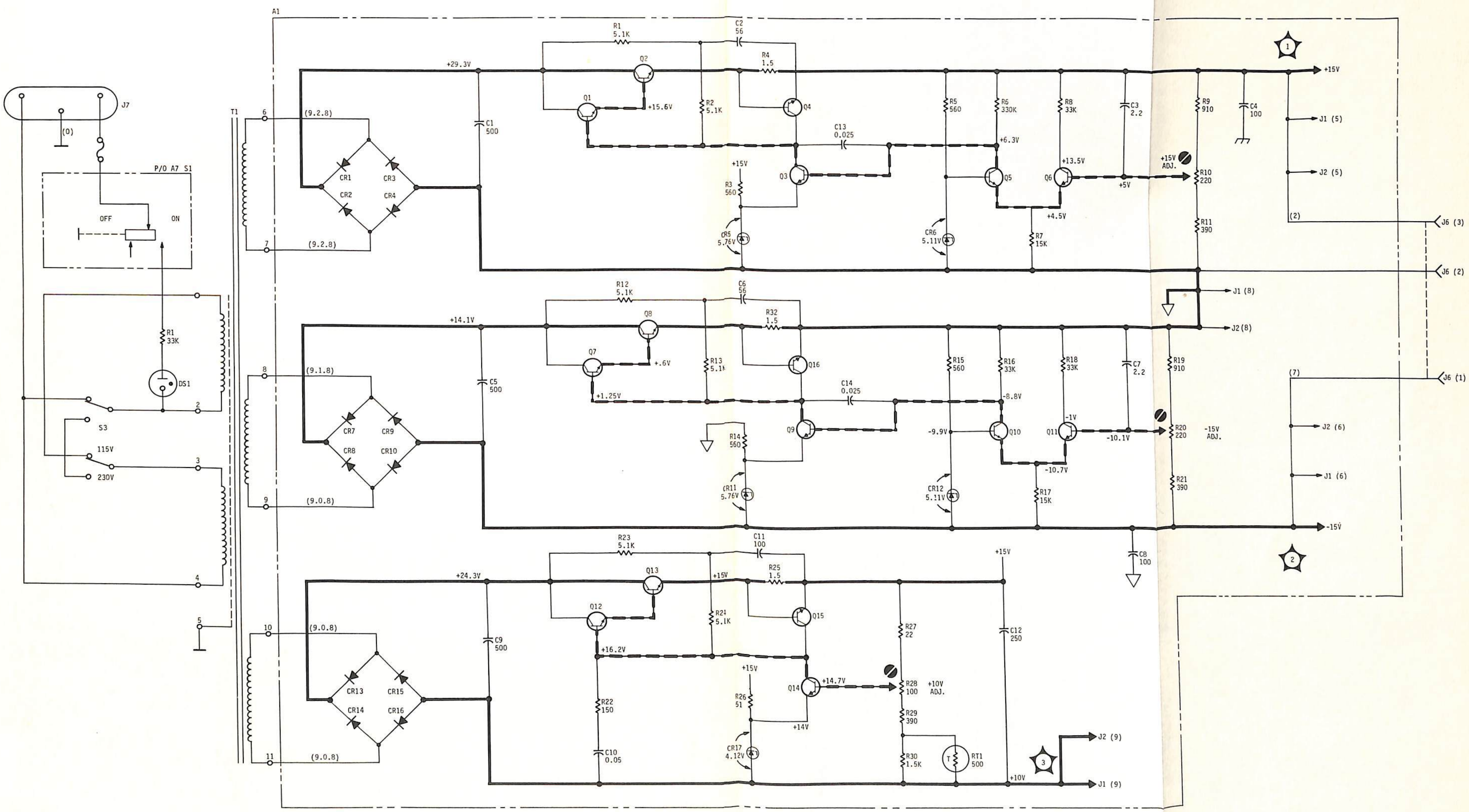
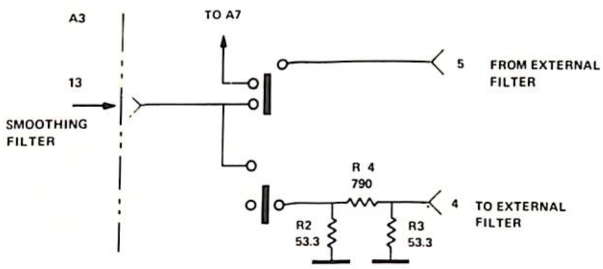


Figure 7–10 Assemblies 1 Circuit Diagram

A1–1 OPTION 001

A1–2 The 8057A Option 001 is the standard model with the attenuator removed. The output level available at the external filter connector is fixed at 99.9dB. The output level at the output connector is fixed at 129.9dB. A circuit diagram of the parts unique to the Option 001 is shown in figure A1–1.



R2, 3	0698–6232	R:fxd, met flm 53.3Ω 1/8W
R4	0698–6230	R:fxd, met flm 790Ω 1/8W
	0360–0114	Terminal Strip
	08057–04102	Cover – Panel

Figure A1–1 Option 001 Circuit Diagram and Replaceable Parts

A1–3 OPTION A85

A1–4 The 8057A is available in light grey panels with olive case, instead of the standard livery, under this option number.

A1–5 OPTION X95

A1–6 The 8057A is available in light grey panels with blue case, instead of the standard livery, under this option number.

BACKDATING

A2–1 MODELS PRIOR TO SERIAL NUMBER G910–00240

A2–2 These models were fitted with:

J7	Power connector	1251–2357
W1	Power cord	8120–1349

A2–3 MODELS PRIOR TO SERIAL NUMBER G910–00180

A2–4 These models were fitted with:

A2R113 R–F 3kΩ 5% 0698–4265

(The present value of A2R113 ensures proper operation of the external gate facility).

A2–5 MODELS PRIOR TO SERIAL NUMBER G910–00140

A2–6 These models were fitted with:

A2C2 C–F 2.2μF 0180–0197

(The present value of A2C2 ensures proper operation of the auto-start circuit).

A2–7 MODELS PRIOR TO SERIAL NUMBER 0963G 00390

A2–8 These models were supplied with light grey panels and olive grey case.

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PRINTED IN WEST GERMANY